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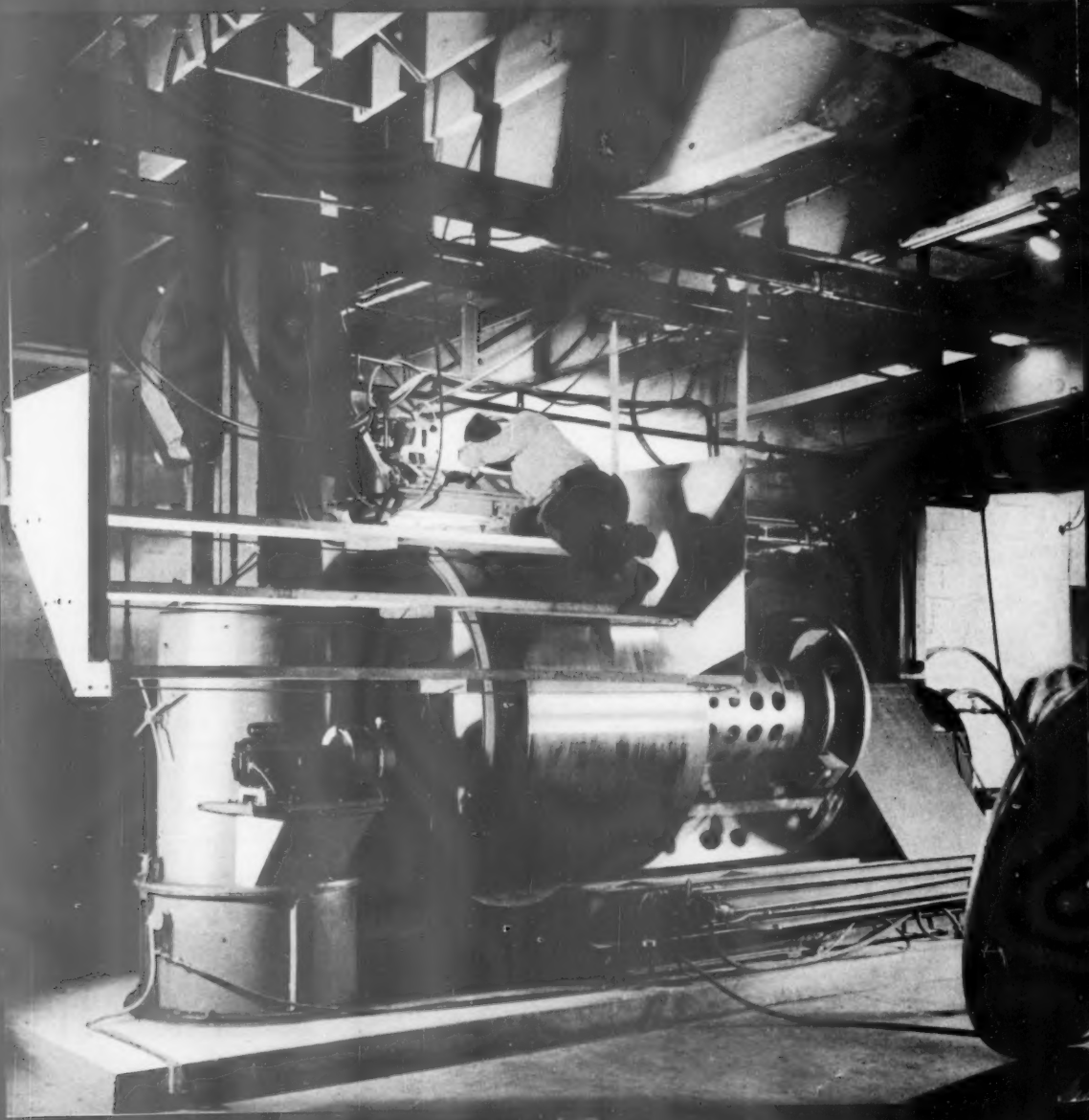
THE WELDING ENGINEER



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Model A-1, electrodes through ¼"
300 amps., 11½" long, 22 oz.

Price $5.50, lower in quantity

Model A-2, electrodes through 5/16"
500 amps., 11¼" long, 29 oz.

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larger handle for greater ventilation
500 amps., 13½" long, 32½ oz.

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When you buy one of the Jackson Holders shown on this page, you buy a holder made of a superior, 98% copper alloy that's heat treated to give it more strength, hardness, and conductivity.

Independent laboratory tests show the following comparison between Jackson Model A-1 and A-3 holders and two competitive makes, also made of copper alloy.

	Tensile Strength lbs. per sq. inch	*Hardness Rockwell "B"*	*Electrical Conductivity*
JACKSON	70,000	70	35%
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Make "C"	25-30,000	10	16%

The Jacksons won on all points: *higher tensile strength*, to take almost any abuse; *greater hardness*, to take the wear and tear between the jaws; *more conductivity*, to take the welding current with a minimum of loss.

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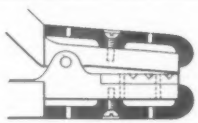

EXTRA!

For even longer economical performance we are now also offering the same three holders as shown here, with the added feature of *replaceable lower jaws.*

Model AA-1 ..... $6.00
Model AA-3 ..... $7.50
Model AA-3S $8.00
All Prices lower in quantity

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THE WELDING ENGINEER

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OCTOBER, 1952

COVER: Precision welding fixture at Cherry-Burrell Corporation's Little Falls, N. Y., plant accurately positions both bottom and side sheets of stainless steel and holds them firmly to accomplish a near-perfect job of welding. Photo was selected for the cover position because it exemplifies this issue's special theme, "The Story of Stainless Steel."

STAINLESS STEEL

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- Automatic Timed Gas Afterflow
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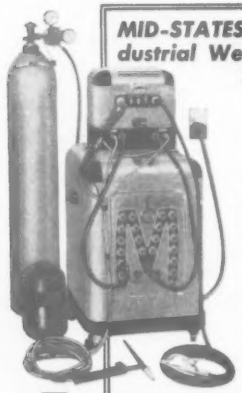

MID-STATES Heavy Duty Industrial Welder Model No. 310.

Amperage Range: 7-300, with Model No. 13AC "MISSING LINK" High Frequency Arc Stabilizer and Inert Gas Shielded Arc Welding accessories.

Yes, your present welder, AC or DC, can be equipped with the Mid-States "MISSING LINK" Arc Stabilizer for inert gas shielded welding. A compact unit with high frequency generating circuit, gas and water control valves, remote control relay and gas after-flow device—all built into one case. It is equipped with standard gas and water hose fittings, ready for inert gas shielded welding attachments. Has selector switch to control length and intensity of high frequency spark to meet varied welding application requirements.

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There are "Missing Link" Models for 0-300, 0-600 and 0-1000 Ampere welders.

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NEWS FROM WASHINGTON

Substitutes a Must for Some Arc Coatings

NPA feels that one of the basic reasons for the recent electrode shortage is the low price that electrodes bring on the market. An increase in the prices consumers pay for this product would permit better profits for the electrode manufacturers, which in turn would increase the availability of wire for electrodes. Even more important, perhaps, a price increase would make better electrodes by allowing manufacturers more funds for research.

At present, we are depending on many short-supply, high-cost ingredients from foreign sources for electrode coatings. Examples are the cryolite, lithium salts, rutile and other scarce materials required for ferrous electrodes. These high-cost materials might be eliminated if there were sufficient profit in the manufacture of electrodes to enable the manufacturer to maintain larger and better research laboratories. A consumable item should always pay its own way in research and development; otherwise its progress becomes discouraging.

NPA "WOC'S" Receive Certificates of Service

EIGHTEEN leading executives and industrialists who have served the government's defense production program without compensation have been awarded Certificates of Service signed by Henry H. Fowler, National Production Authority Administrator, and by Charles Sawyer, Secretary of Commerce. Likewise, all received letters of commendation for "a job well done."

All eighteen have returned to private industry. Included in the group are: Lincoln G. Love, of Ford Motor Co., who served as deputy director, Metal Working Equipment Division, and Howard L. Rich, who served as chief of the products distribution branch of the same division.

OPS Gives Rules for Increasing Prices

OFFICE of Price Stabilization has laid down the rules under which manufacturers of construction materials and equipment can pass along the increased metal costs incurred by the recently allowed increase in steel prices.

As issued in general and overriding regulation 35, the new rules put a limit on the increased prices that contractors will have to pay.

GOR 35 permits a manufacturer to raise his ceiling price only by the additional dollars and cents he must pay for steel, copper and aluminum. The raise must be the exact amount of the cost increase —pyramiding isn't permitted. This means that the price of a piece of construction equipment requiring three tons of steel can be boosted only $15.60—three times the $5.20 per ton increase allowed the steel mills.

On dealer sales, though, regulation 30 is still in force. That means that the dealer can apply his mark-up to the fabricator's new ceiling price.

Price increases will be gradual because producers will have to wait for shipments of the higher cost metals before they can adjust their price ceilings. The increases are expected to come frequently, however, as manufacturers usually don't get delivery of all materials and components simultaneously.

Centralized Military Purchasing Is Coming

BEFORE long the military will begin to increase purchasing under a new centralized control, which should help to cut costs considerably. At the same time, a very determined effort is being made to standardize on equipment and supplies used by all branches.

The military and the Atomic Energy Commission will continue to use priority numbers and symbols to insure an unbroken line of supply for their programs.

NPA Manpower Drastically Reduced

CUTS in employment are in prospect for NPA workers. Effective September 26, NPA will reduce its labor force from 4,400 to 3,600. On January 1, a further cut will be effected, reducing the force to a maximum of 2,200. Sections, branches and divisions will be brought closer together or doubled up—doubling up is the present plan for the mining and construction machinery divisions. The higher limits on self authorizations also automatically eliminate the need for a large field force.

As far as our own industry is concerned, only 50% of the welding equipment manufacturers will come under the self-authorization limits and none of the electrode manufacturers. This means that NPA will continue to control allotments for the welding industry —at least until the second quarter of 1953. From the second quarter on, however, NPA will probably be on a standby basis, for self-authorization limits will be high enough to eliminate the need for "tickets."

Expansion goals will continue to receive priorities after April 1 if necessary. However, most of the goals should be fairly complete by then.

Steel Industry Feels Uneasy over Future

REPORTS are prevalent that steel executives are getting apprehensive over their industry's ability to sell the 115,000,000 tons of steel ingots that the industry is geared to make during the coming year. Looking ahead into 1953, they take into consideration the eventual leveling of unbalanced inventories in the steel-consuming industries and see the supply and demand nearly in balance by the end of the first quarter. Steel inventories are expected to build up rapidly even though they are down by 10,000,000 tons since the strike.

NEWS FROM WASHINGTON (Continued from page 5)

Electrode Shortage Is Not Too Severe

THE STEEL strike has not made as bad a shortage in electrodes as was originally anticipated. By the fourth quarter of this year, electrodes will be produced at a rate in excess of the demand, but it will take a while to get all the channels of distribution filled. After January 1, most of the common electrodes, including lower grades of stainless steel, will be readily available from suppliers.

At present NPA is receiving very few demands to expedite wire except for the high alloy and small-size electrodes.

The welding machine situation looks equally good except for the 600-amp and large engine-driven equipment; this type will be in short supply for a while longer.

Welding electrode production always lags about 60 days behind steel, but recently steel increased nearly 50% while electrodes only increased 30%. NPA figures as a basis for future consumption a ratio of 40 lb of welding electrodes for every ton of plate, shape and structural steel manufactured. This is just one of several reasons for the electrode shortage.

Jets Need Nickel, So No Change for Stainless

THE STAINLESS-STEEL industry has been told by NPA that there "definitely will not be any change in the supply situation for nickel during the next year at least." Any improvement in the nickel supply that may exist from time to time is only a temporary adjustment resulting from changes in certain types of demands and programs. Stockpile needs are as great as ever, and the jet program is expected to double its demand soon. Every jet plane requires an average of 2,400 lb of nickel.

Even though large supplies of austenitic stainless steels are still in the future, it may not hurt to look ahead. Long before 25-20 stainless steel is available, 18-8 is expected to be in surplus. The reason will be due principally to the economics of running a wire mill. Wire manufacturers can produce better than two pounds of 18-8 against one pound of 25-20, so they will probably turn out 18-8 until the market becomes glutted. Product manufacturers will just have to sit tight and hold out for the analysis they need.

West Coast Aluminum Capacity Now Increased

PLANT of the Reynolds Aluminum Co. at Longview, Wash., has increased its capacity for producing aluminum by 65%. The plant's total capacity is now 100,000,000 lb annually as against a former capacity of 40,000,000 lb. The expansion has been accomplished by an ingenious engineering process of "stretching" the plant's 372 pots without adding additional floor space.

Plans to build a $1,000,000 cryolite recovery plant (see "News from Washington," July, 1952) adjacent to the reduction unit are announced by R. S. Reynolds, chairman of the company.

A disquieting note, though, is the enormous loss of aluminum production because of power shortages in the Pacific northwest. Total losses may run as high as 119,000,000 lb of aluminum for September, October, November and December. Losses are due to the slashes of "interruptable" power to the plants in the area during September.

Barge Industry Is Having Tough Time

DEPLETED steel inventories have brought the barge-building industry to a virtual standstill, shipbuilders told the National Production Authority last month.

Some members of the Builders and Repairers of Inland Waterway Vessels Industry Advisory Committee said they have not put any new barges on the ways in the last two months for lack of steel.

Employment has been reduced a third in one shipyard since June and is down from 900 men to 500 and still falling in another yard, committee members said. Repair jobs and construction of tow boats, which require less steel than barges, are being relied on to keep yards open, they added.

Steel mills have indicated that second and third quarter, 1952, allotments ("tickets") accepted before the steel strike will be filled by the end of this year, shipbuilders said.

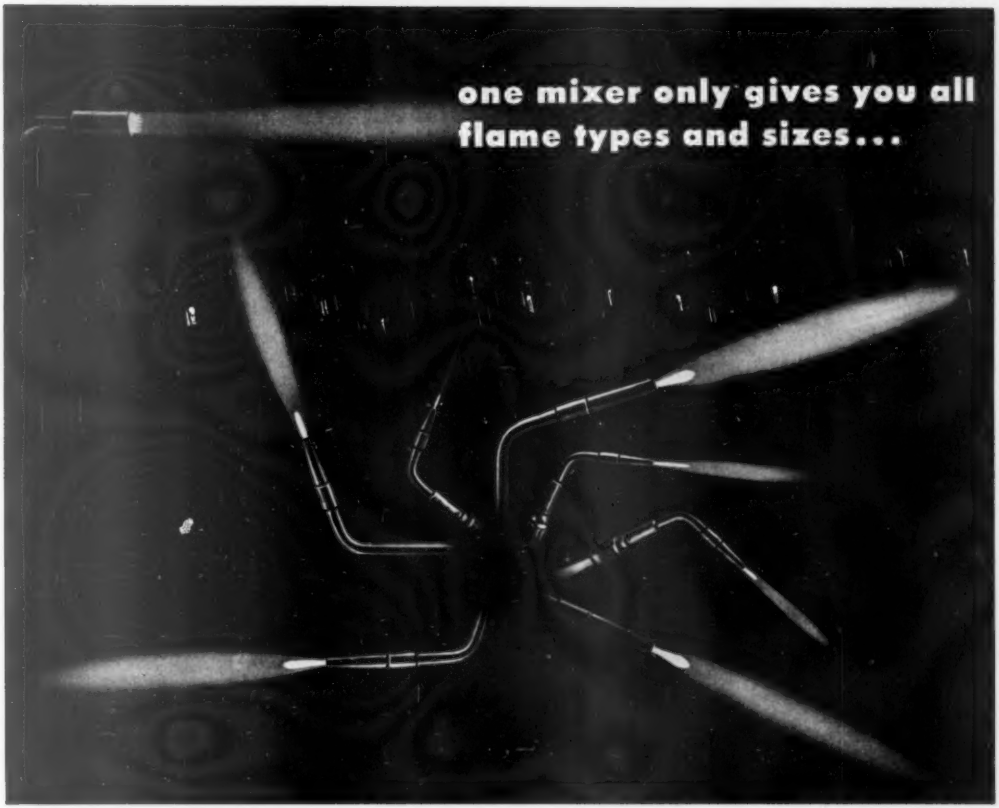
Standardize Tanks for Liquid Oxygen

BY A SYSTEM of careful cataloging and planning, the number of different specifications for liquid oxygen containers used by the government has been reduced considerably. Formerly, there were six different specifications for such tanks, each one for a different branch of the government. The Munitions Board Standards Agency, under the supervision of Russell A. Moody, has eliminated five of the six by standardizing on one container that is acceptable to all concerned.

If welding rod packaging were to be standardized the same way, it would effect a considerable saving when packaging is figured at 6% of the cost of procurement. See "News from Washington," July, 1952.

Allotment Violators May Get Theirs Yet

EVEN though shortages of most metals are pretty well past, the Administration will continue to prosecute violations for allotment abuses. They reason like this: If a thief stole your overcoat during the winter and you caught him with it during the summer, wouldn't you send him to jail even though you didn't need the coat at the time? Because you don't need an overcoat when you catch the thief, it doesn't mean that stealing isn't a crime.



You won't need extra torch mixers when you use the modern welding equipment made by San Francisco's oldest producer of fine apparatus for flame cutting and gas welding.

Save the added cost of numerous mixers—limit the nozzle weight to be carried by the operator — lower your initial and your future costs — buy the efficient and modern equipment made by *National*

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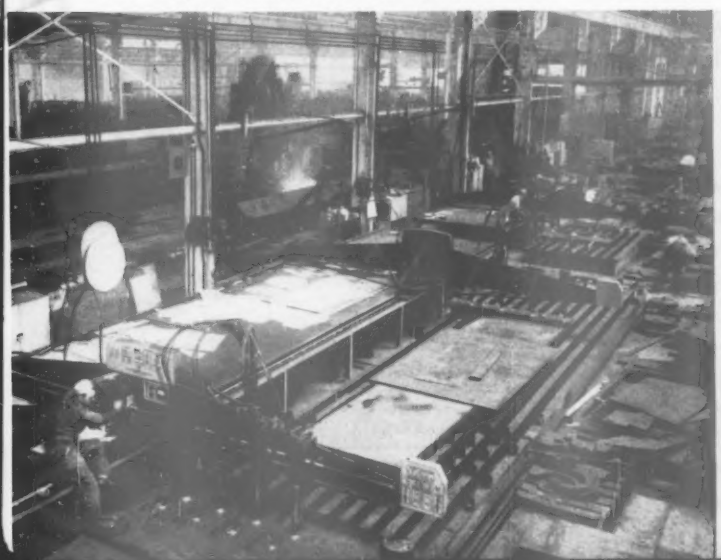
322

What happens when an aircraft manufacturer turns his talents to house trailers? At Spartan Aircraft Company in Tulsa the result, as you might expect, is a mobile home embodying the best features of aircraft design: light, yet strong, with minimum wind resistance; compact, yet commodious and comfortable. Spartan's mass production techniques bring a completed trailer off the line every 18 minutes. Seven NCG Sureweld A-C Welders, centrally positioned, permit fast, efficient welding of chassis frames. A Sureweld Portable D-C Welder (shown below the A-C machines) is a timesaver for maintenance and repair at Spartan. It can be moved quickly and easily anywhere throughout the big 40 acre plant.



Three NCG automatic flame cutting machines help speed production at the Whiting Corporation, Harvey, Ill., one of the nation's leading producers of foundry and railway equipment, material handling equipment, rotary shears, chemical equipment and special machinery. Two of the machines are mounted on one long table to provide a 40-foot cutting length. Parts being cut in this picture are for Whiting's new "Trackmobile." Whiting has used NCG cutting equipment for ten years.

AT RIGHT: Rego KX Hand Cutting Torches and NCG's Cut-O-Matic and RS Cutting Machines speed production at Welded Steel Shapes, Inc., structural steel fabricators at Coatesville, Pa. NCG's pipe-line system, fed from portable banks, keeps NCG gases flowing conveniently and economically at this modern shop where work ranges from the fabrication of buildings and bridges to farm equipment.

Get it done faster and better with **NCG**

In plants and shops across the country NCG equipment is proving that it can get work done more profitably

In times like these when all basic costs are high, one of the solutions for profitable production is selecting tools that will help get jobs done easier, faster and better—that can be depended on, too, to stand up under heavy use without costly maintenance.

NCG customers from coast to coast are getting this profitable kind of help from NCG equipment. You can get it, too!

Whatever your needs are for welding or flame cutting equipment, find out what NCG has to offer before you make a choice. Your nearest NCG office or the authorized NCG dealer in your locality is able and anxious to help you. And you'll like the interest they take in making your problems their own.

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Welding Monel-Clad Steel?

"140"s are right!

If you are doing any of the following jobs, Inco's *"140" Monel* electrode is the one to use:

1. Welding the clad side of Monel-Clad Steel.
2. Overlaying Monel on steel.
3. Joining wrought or cast Monel and nickel to steel and stainless steel.

The *"140" Monel* electrode has a special low-carbon flux coating which enables you to make crack-free deposits of Monel® directly on steel.

For special applications, the *"140" Monel* electrode offers other important advantages:

- Eliminates the need for a seal bead of nickel in welding the clad side of Monel-Clad Steel.
- Eliminates need for a barrier layer of nickel weld metal between steel and Monel overlays.
- *"140"* welds have corrosion resistance and physical properties comparable to solid Monel.

Although not recommended specifically for that purpose, *"140" Monel* electrodes may be used to weld solid Monel in place of the standard *"130" Monel* electrode.

Because of the heavy demands being made on our resources by the national rearmament program, you may not be able to get all the Inco welding materials you need. If you encounter problems in welding any of the Inco Nickel Alloys, remember that Inco's Technical Service Department is always ready to assist you.

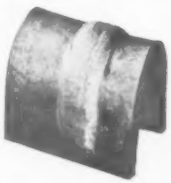
Technical Data for "140" MONEL ELECTRODES

Current requirements: **D.C., reversed polarity**

3/32" dia. — 35 - 60 amps.
1/8" dia. — 70 - 110 amps.
5/32" dia. — 110 - 150 amps.
3/16" dia. — 140 - 190 amps.

Properties of welds:

Joint	Tensile P. S. I.	% Elong.
Monel to mild steel	70,100	45
Nickel to mild steel	64,600	49
Monel to Type 316 stainless	87,800	44
Monel to Type 347 stainless	81,100	48



Guided bend test specimen of welded overlay made with new "140" Monel electrode directly on 3" by 6" by 3/8" steel plate. Note the excellent ductility and adherence of the deposit.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

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NEW
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3. New Side Shields
4. New Easy Lens Replacement

AO's newest development in eye protection—Chippers' and Welders' Coverglas Goggles—can be worn over practically every pair of personal glasses (even the biggest frames) and most types of safety prescription goggles *with and without side shield.*

Wider vision, too, because the lenses are larger and scientifically designed to give up to 20% more vision. Yet, with all these features the goggles weigh but a fraction of an ounce more than ordinary Coverglas goggles . . . cost only slightly more.

These goggles are the newest . . . and two of the greatest . . . developments since the advent of safety goggles. Get all the facts about these two outstanding Coverglas goggles from your AO Safety Products Representative. He can supply you.

QUICK FACTS

- Lens easily replaceable from rear (not front) by means of a spring clamp—no tools needed
- Lightweight, brown plastic cups fit face snugly, won't conduct heat or electricity
- Light-tight side shields for welders (on No. 327 goggle) provide indirect ventilation
- Bridge—High-grade leather. Instant adjustment
- AO worker-lab tests show much greater field of vision and increased comfort
- All-rubber headband, easily adjustable

"326" Chippers' Coverglas goggle supplied with regular Super Armorplate lenses. "327" Welders' Coverglas goggle supplied with regular Noviweld lenses and cover lenses.

AO's Industrial Vision Program Increases Production, Decreases Accidents. Write today for booklet "Improved Industrial Vision" to 1011 Vision Park, Southbridge, Mass.

American Optical Company
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

ALLOY RODS COMPANY

The Leading Manufacturer of Alloy Arc Welding Electrodes

PRESENTS

THE FIRST "INSIDE STORY" FILM

OF HOW ARC WELDING ELECTRODES ARE MADE

"No Finer Electrodes Made... Anywhere"

A 22-MINUTE SOUND MOTION PICTURE IN FULL COLOR

MADE INSIDE ALLOY RODS' YORK, PENNSYLVANIA PLANT

Never before to our knowledge, since arc welding became of age as a major fabricating tool for American industry in the early 1930's, has any electrode manufacturer permitted the public to see how coated arc welding electrodes are made. The manufacturing processes and procedures have always been carefully guarded trade secrets.

Now, for the first time, *Alloy Rods Company* has filmed its entire manufacturing process in the interests of better trade relations and technical understanding... from the cold drawing of hot rolled rod to the packaging of its finished electrodes in moisture-proof metal containers. You can now see how arc welding electrodes are made.

"No Finer Electrodes Made... Anywhere" is not a sales film or promotional tool. It is technical and instructional... shot on the production lines and in the laboratories ...to show those interested in better arc welding why we make electrodes this way. Prints of this film are available, without charge, to any reputable organization or institution.

WRITE, WIRE, OR TELEPHONE to Department M if you would like to use this film for any organizational or educational purpose. We will try to have a print available to fit your next open date.

ALLOY RODS
COMPANY
YORK PENNSYLVANIA

NO FINER ELECTRODES MADE ANYWHERE

AR-12

WORLD PREMIERE At the Metal Show, Philadelphia, Pa., October 20-24, 1952
... showing every hour on the hour, Alloy Rods' Exhibit, Booth 448, Arena

These "Firsts" Helped Westinghouse Customers

USERS OF WESTINGHOUSE TUBES GET FIRST BENEFITS FROM MANY NEW TUBE DEVELOPMENTS

These are only a few of the "firsts" that Westinghouse created in the electronic tube industry. In each case, designers using Westinghouse Tubes gained advantages by having first chance to use these innovations.

Today, Westinghouse still pioneers in electronic tubes and tube making. For instance, Westinghouse 40 KV and 20 KV rectifying tubes are under 9 ounces, only 2¼" high. Designers seeking the ultimate in space and weight savings will find them in these new WL-6102 and WL-6103 tubes.

Radical new developments in other power tubes and receiving and television picture tubes are now being engineered at the *NEW* Westinghouse Electronic Tube Division at Elmira and Bath, New York.

NEW SERVICE, NEW DISTRIBUTION

Westinghouse plans for Electronic Tube Division expansion are in operation. New service facilities, new warehousing policies, and new distributors are opening rapidly.

New merchandising methods will aid distributors in serving industrial users—many of these business-building programs are totally new in the tube industry. Here, as elsewhere, Westinghouse plans to provide industry leadership in service.

It pays in profits to deal with Westinghouse and with Westinghouse distributors. For full information on how Westinghouse can help you with problems of design, service, or supply, call your nearest Westinghouse representative, or write to Department D-110.

1920 **Westinghouse Makes First Dry Battery WD-11 Tube**

Westinghouse Testing New Indirectly-Heated Tube

1921

WESTINGHOUSE INVENTS NEW KU-610 THYRATRON

1926

1928 ***Announce New Photo-Tube and Long-Life Cathode Ray Tube***

1929 **Westinghouse Patents KOVAR for Metal-to-Glass Tube Sealing**

1931 **Westinghouse Unveils First High Power UHF Tube**

1932 **Westinghouse Tells of New Ignitron Tube**

1941 **WL-530 in Radar at Pearl Harbor**

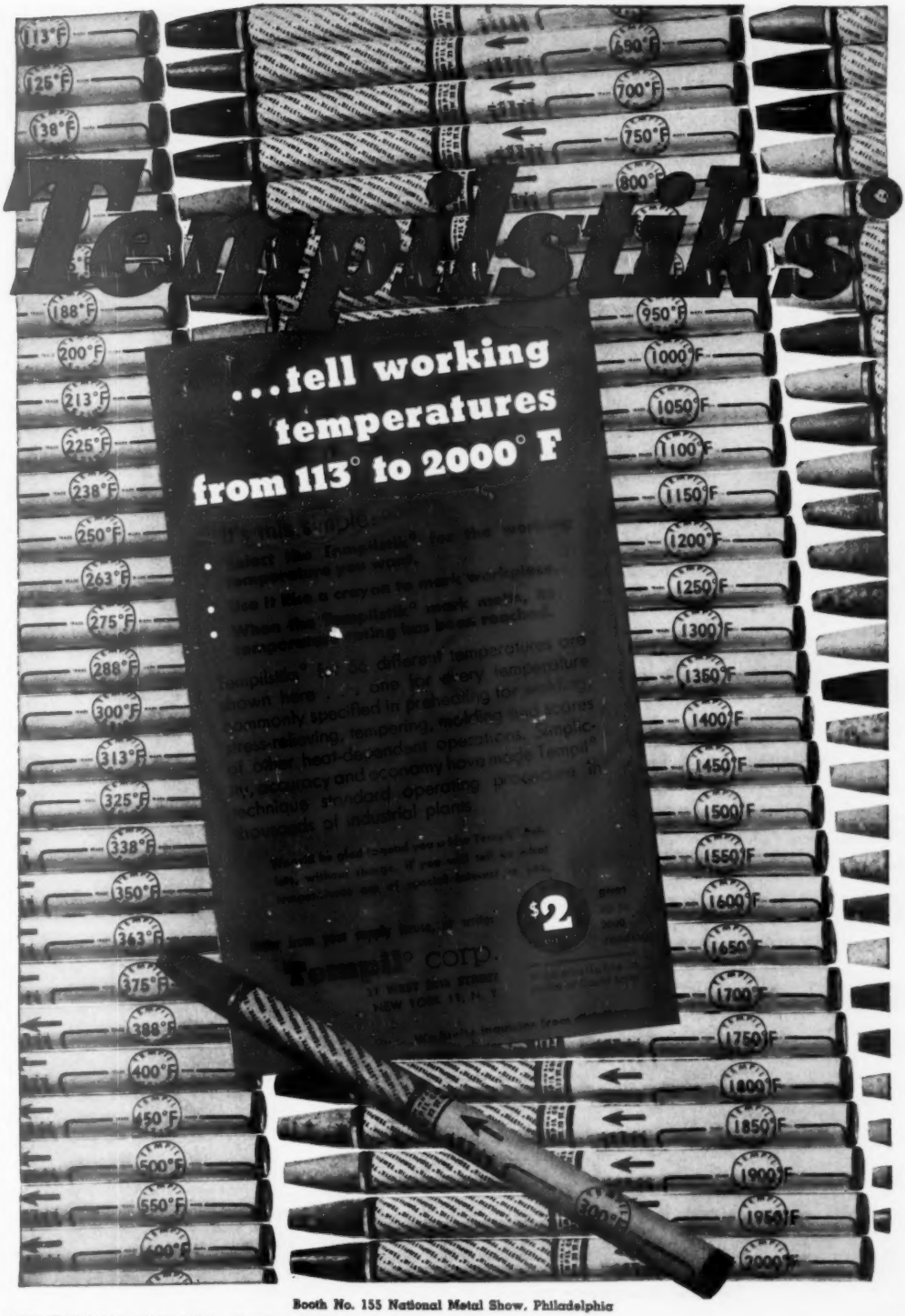
RELIATRON™ TUBES

YOU CAN BE SURE...IF IT'S Westinghouse

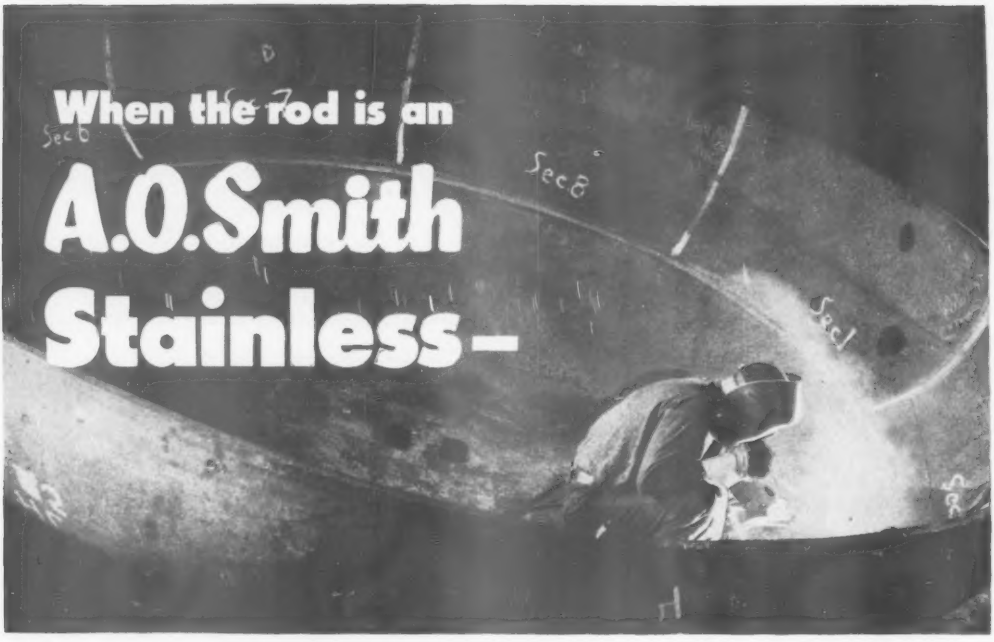
ET-95003

ELECTRONIC TUBE DIVISION

Westinghouse Electric Corporation
Box 284, Elmira, N. Y.



Booth No. 155 National Metal Show, Philadelphia



–you know it's right

BECAUSE of A. O. Smith's matchless quality control

You, too, can eliminate field failure due to weld corrosion, with A. O. Smith stainless electrodes . . . your "insurance policy" that *your* specified requirements are met *exactly.*

"Tramp" steel cannot enter for manufacture because our quality control prevents it. No incoming coil of stainless core wire is ever acceptable for processing until exacting chemical, metallurgical and *spectrographic* analyses *prove* that it matches our specifications from end to end. This assures you of receiving the exact type and analysis of stainless to meet your job specification.

For your protection here are some of *our* controls: No more than one splice is permitted in any incoming coil. Why? So that, when we clip samples from each end of each coil for analysis, no part of any coil can escape the test. Then, when approved coils are straightened and cut, the wire is immediately sealed in boxes to prevent mixing of lots.

As one of the largest users of stainless electrodes in building stainless vessels, A. O. Smith knows that these tests and precautions are necessary to assure top-quality production. No other electrode producer subjects stainless core wire to the exacting spectro-analysis, chemical and metallurgical tests as is done by A. O. Smith.

When you buy A. O. Smith stainless electrodes, you receive this matchless assurance of highest quality without paying any premium! A compelling reason for *insisting* on A. O. Smith stainless every time!

We'll welcome the opportunity to demonstrate A. O. Smith stainless electrodes on your job.

Write for free pocket-size electrode handbook.

A. O. Smith Certified Stainless Electrodes

ALL-POSITION

Electrode	AISI Type
SW-151	502
SW-152	505
SW-153	410
SW-154	430
SW-157	347
SW-158	317+Cb
	318
SW-159	310
SW-160	316
SW-161	317
SW-162	308
SW-166	309
SW-168	310+Mo
SW-169	310+Cb
SW-357	347
SW-359	310
SW-362	308

Available through A. O. Smith Welding Products Distributors

Made by welders . . . for welders

A.O.Smith
WELDING PRODUCTS
Milwaukee 1, Wisconsin
International Division: Milwaukee 1

78th ANNIVERSARY

See A. O. Smith advertising in TIME and NEWSWEEK.

Welding Info-Aids

201 RESISTANCE WELDING—Weldaloy Products Co., Hazel Park, Mich. Heavy covered, 112-page catalog has exceptionally complete data on every type of spot, projection, seam, flash, butt and barrel welding electrode and holder. Welding data on various metals, conversion tables, diagrams welding hints and many photos illustrate this excellent book.

202 ELECTRODE MANUAL—General Electric Co., Schenectady 5, N. Y. A 52-page pocket-size (4 by 7½ in.) booklet describes the application, chemical analysis and mechanical properties of G-E welding electrodes. It also includes a stainless-steel electrode chart and a "troubleshooting" chart. The latter takes a problem such as poor appearance, undercutting, excessive spatter, arc blow, porous welds, etc., and gives its possible causes and possible corrections. Another chart gives the number of electrodes of specific type and specified diameter needed to deposit a pound of weld metal.

203 METALLIZING BOOKLET—Metallizing Engineering Co., Inc., Long Island City 1, N. Y. Booklet titled "Metallizing—Its Practical Applications" describes the basic process, tells how it's done, gives advantages and limitations. There are three pages of photographs of various jobs and three case histories. The case histories describe the use of metallizing in connection with corrosion resistance.

204 POSITIONERS—Arcweld Machine Machine Co., Arcade, N. Y. Single-sheet bulletin pictures and points out features of the new Model HTS-5 head and tail stock positioner for welding of heavy structures and vessels. Diagrams and tables show capacities, dimensions and operating characteristics.

205 VAPOR DEGREASERS—Phillips Mfg. Co., Chicago 45. 12-page bulletin on heavy paper describes vapor degreasing equipment for efficient, quick cleaning of metal before or after welding, machining, plating, galvanizing, etc. Many models are illustrated and application photos show various products being cleaned by the various exclusive features in the Phillips machines.

206 INERT-ARC WELDERS — Viking Sales, Inc., Kalamazoo, Mich. Four-page handsomely printed 8½ by 11 in. bulletin in several colors describes the Viking line of inert-arc welders. The 16 models in the line features such advantages as built-in power factor correction, built-in high frequency, remote control of high frequency, remote control of primary circuit contactors, automatic gas control and automatic gas afterflow. Four models are also equipped with an automatic timer for spot-arc welding.

CARDS NOT GOOD AFTER JAN. 1, 1953

TO OBTAIN: (1) manufacturer's catalog or bulletin described on this page; information on (2) a new product item or (3) an advertised product, use the card sections printed below. Insert number of catalog or new products item or page number of advertised product (add initials of the advertiser if more than one ad appears on the page). THE WELDING ENGINEER will ask manufacturers to send the information requested.

Each card section must be completely filled out. Do not use ditto marks. These cards are not good after Jan. 1, 1953.

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207 WELDING JIG—The Edmands Co., Providence, R. I. 4-page bulletin tells all about the "Twinner Vise" for positioning parts for welding, brazing or riveting. Made in two models, both shown, the positioner is in wide use in England and Europe for its versatility, broad capacity and efficiency.

208 FLAME-CUTTING PIPE—Vernon Tool Co. Ltd., Alhambra, Calif. 4-page bulletin No. P-2 tells about the Vernon pipe-cutting pantograph for making all types of beveled cut-offs. How it works, along with optional equipment for special jobs, is clearly explained. Most parts are clearly shown and are listed.

209 WELDING ALLOY CATALOG—All-State Welding Alloys Co., Inc., White Plains, N. Y. This new 32-page booklet is a complete buyer's guide to the whole line of All-State welding alloys, silver solders, brazing compounds and fluxes. Information on joining of all the common metals is also included.

210 AIR CYLINDERS—Miller Motor Co., Melrose Park, Ill. 8-page bulletin gives data on the engineering, design, construction and mounting of air cylinders. It covers cushioned and non-cushioned cylinders, single and double acting, single and double rod end, spring return and oversized rod cylinders. Included are drawings of 13 different mounting styles in 1½ in. through 14 in. bores.

211 WELDING AND CUTTING—Victor Equipment Co., San Francisco 7. 18-page, pocket-size booklet No. 880 gives compact information on Victor welding and cutting torches and attachments. Prices are included for both torches and all accessories, pictured or listed.

212 SAFETY CATALOG—The Boyer-Campbell Co., Detroit 2. 144-page catalog is a complete presentation on face shields, welding helmets, safety clothing, goggles, cleaners, bandages, safety devices for machines of all types, safety lanterns, etc.

213 STAINLESS TUBING—The Babcock & Wilcox Co., Beaver Falls, Pa. 4-page, two-color bulletin TDC 143 tells about two economical stainless tubing steels, Types 410 and 414, that can be hardened by heat treatment to good mechanical properties. Data on welding, forging, machining, etc. is included.

214 WELDED BUS BARS—Reynolds Metals Co., Louisville, Ky. Company publication Technical Advisor No. 19 tells about a 10,000 ton installation of all-welded aluminum bus bars at Reynolds new San Patricio reduction plant, Corpus Christi, Tex. Six pictures explain how it was done with the inert-metal-arc process.

215 IGNITRON TUBE—National Electronics, Inc., Geneva, Ill. Single-sheet bulletin describes the NL-1001 ignitron tube specially designed for welder control and similar a-c control jobs. Requirements, characteristics and diagrams of it operations are shown.

216 HARD-FACING ALLOYS—Wall Colmonoy Corp., Detroit 3. 12-page catalog No. 77, contains a wealth of pictures and text explaining various Colmonoy alloys, the "Sprayweld" process, "Nicrobraz" stainless brazing alloy, special applications and finishing of the firm's hard-facing compounds.

217 CHAIN HOIST—Coffing Hoist Co. Danville, Ill. Bulletin has several clear views of "Safety Pull" coil chain ratchet lever hoists for welding shops, machine shops, farms, etc. Specs are tabulated and operating features pictured and explained.

218 ALUMINUM FORMING—Reynolds Metals Co., Louisville 1, Ky. 148-page technical manual contains a wealth of information on how to draw and form aluminum sheet, plate, tubing and pipe. The book is divided into four sections. Section one gives aluminum sheet and plate data; section two covers the forming of sheet and plate by different processes; section three gives tubing and pipe data, and section four covers the machine forming, press forming, stretch forming, roll forming, hand forming and swaging of tubing and pipes. In addition, the book includes an index of illustrations by subjects, an index of formulas by subjects, an index of tables by subjects and an itemized cross index. To get a copy of this booklet, you must write to the manufacturer for it on your business letterhead.

219 MAGNESIUM FINISHING—Dow Chemical Co., Midland, Mich. This 128-page manual, "Magnesium Finishing," is a revision of the company's previous manual on finishing systems for magnesium products. It describes in detail such surface treatments as cleaning, mechanical finishing, chemical treatments, electroplating, painting, assembly protection, etc.

220 GAS DETECTORS—Johnson-Williams, Ltd., Palo Alto, Calif. Four-page, letterhead-size bulletin covers detectors, indicators, alarms and controls to protect against combustible and explosive gases. This folder illustrates the various models, describes principles of operation, lists accessories and spare parts, shows typical users and applications.

221 FAN CATALOG—Chelsea Fan & Blower Co., Inc., Plainfield, N. J. Catalog, price sheet and engineering bulletins covering 30 fan types in over 300 sizes are compiled in this booklet. Application data tells how propeller fans are used in every sort of industrial, commercial and residential situation.

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Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered to save maintenance manhours

Scrappy says, "Aid defense—more scrap today... more steel tomorrow."

Write Dept. N-10 for free booklet giving Dimensional Data on types, sizes and materials of TUBE-TURN Welding Fittings and Flanges.

THIS TUBE-TURN WELDING ELBOW is engineered for shape, size, dimension, and wall thickness . . . to provide you with permanent, leakproof piping. It is forged by the only process that produces a wall as uniform in thickness and true in circularity as the original seamless pipe . . . guaranteeing accurate fit-up and *full strength throughout.*

More than ever, any piping installation you make should be maintenance-free, and have extra long life . . . that's why it pays to *specify* TUBE-TURN Welding Fittings and Flanges. For good service call on your nearby TUBE TURNS' Distributor . . . you'll find one in every principal city.

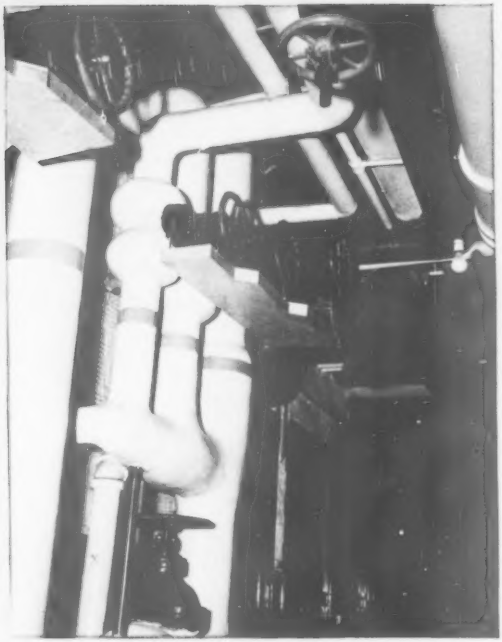
Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

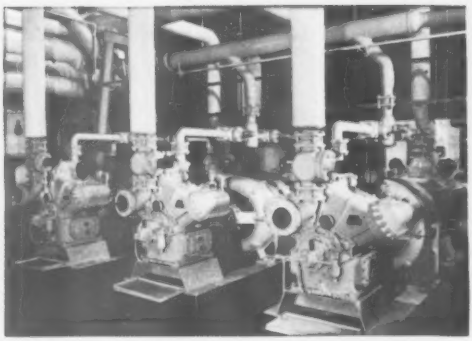
DISTRICT OFFICES: New York · Philadelphia · Pittsburgh · Chicago · Houston · Tulsa · San Francisco · Los Angeles

TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

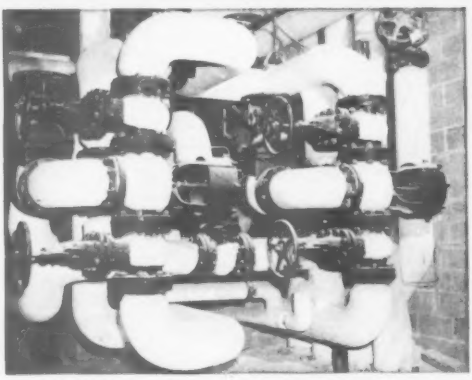
Large buildings cut maintenance with welded piping ...using TUBE-TURN Welding Fittings



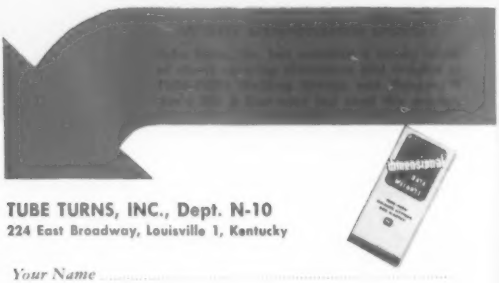
FAMOUS HOTEL—New York's Waldorf Astoria uses 160,000,000 pounds of steam annually . . . and has the most extensive air conditioning system in the world. For top efficiency, all main lines, such as this piping to a steam header, are welded. Directional changes are made with TUBE-TURN Welding Fittings. All necessary types of welding fittings for any job, large or small, can be obtained from TUBE TURNS, INC. . . . which offers the world's broadest line of welding fittings and flanges, in a wide range of types, sizes, and more than 40 different alloys.



DEPARTMENT STORE—Long known for progressiveness in the retail field, the Lazarus Company was one of the first to air condition its selling areas. Facilities have since been extended to all 32 acres of floor space. To keep maintenance to a minimum, an all-welded piping system, using reliable TUBE-TURN Welding Fittings and Flanges, was specified for refrigeration equipment, condensers, pumps, etc. Thus joints are permanently leakproof, and insulation is on for life.



HOSPITAL—All piping from 2" up, for new addition to Mount Carmel Hospital in Columbus, Ohio, is welded, with TUBE-TURN Welding Fittings specified throughout. In this maze of steam piping to a hot water converter, welded piping fits neatly into a small space. With no flanges to work around, insulation was applied easily. This leakproof piping system eliminates the danger of interruption of vital services.



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Nature of Business .....

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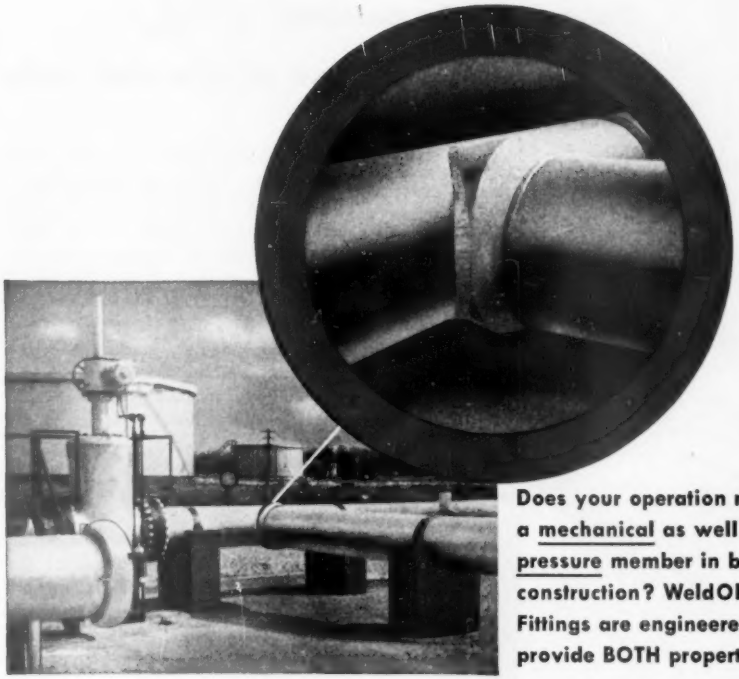
ENGINEERED REINFORCEMENT

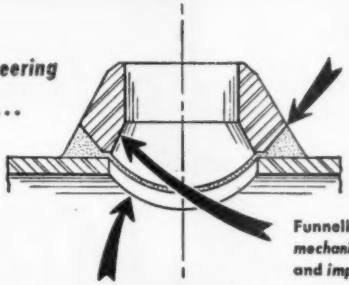
FOR YOUR BRANCH CONNECTIONS



Does your operation require a mechanical as well as a pressure member in branch construction? WeldOlet Welding Fittings are engineered to provide BOTH properties.

A big portion of your engineering job is done for you, if you...

Specify Bonney WeldOlet Welding Fittings to Insure Permanent Strength


Reinforcement where both the mechanical and internal stresses are most severe
Funnelled to relieve mechanical stress concentrations and improve fluid flow
Shaped and beveled for clean, quick and economical installation

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WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

ENG. DEPT., 354 GREEN STREET

ALLENTOWN, PENNSYLVANIA

BUTTERING WAS THE ANSWER!

Saved costly casting . . .

allowed use of low cost rods

Need for complete re-making of a large, costly composite machine frame threatened a prominent Western mining equipment builder. Weld metal was picking up harmful impurities from the cast part—it was impossible to obtain satisfactory welds using the electrodes specified.

The local M&T salesman joined with company welding engineers . . . experimented . . . and sparked a solution! On his advice surfaces of the casting where welding was required were simply "buttered" with Murex Type HTS before the bulk of the weld metal was deposited.

Results were: complete elimination of pickup so that remaking of the casting to new metallurgical specifications became unnecessary. And, the specified electrodes, on hand for the job, could be used.

Your nearby M&T representative is qualified to give you expert assistance on any welding problem. Call on him when you need help. Make use of his broad background of experience in every phase of welding.

MUREX®

Electrodes

Arc Welders • Accessories

METAL & THERMIT CORPORATION 100 East 42nd Street, New York 17, N. Y.

OCTOBER 20-24 • PHILADELPHIA, PA.

...after
nine years
steady use

STANDARD STEEL TREATING CO.
3487 Lovett Avenue • Detroit 10, Michigan • Phone LAfayette 2333
Harris Calorific Sales Co.
7401 Dubois Street
Detroit 11, Michigan
Gentlemen:
We thought it might be of interest to you to know that after nine years steady use we find it necessary to finally replace one of our #18 Harris Automatic Torches.
This torch is one of a number of this type in use in our straightening department and we can state without reservation that all have given exceptional service at practically no maintenance expense except for tip replacement.
Very truly yours,
STANDARD STEEL TREATING CO.
James D. Thompson, Gen. Mgr.
JDT:MS

practically
no
maintenance
expense...

To the advantages named in Mr. Thompson's unsolicited letter, important as they are, we must add another that might not be obvious to those who have never used a Harris Automatic Torch. That is, in nine years of continuous operation the thumb control lever (circled at right) must have been actuated many thousands of times. Each and every time it saved money. Using it to restore the full flame from pilot light eliminates the time, motions and gases wasted in flame adjustment of a standard torch. Using the thumb control to shut off the full flame saves oxygen and acetylene that is wasted when the full flame burns but is not applied to work. All these things combine to yield a tremendous return on torch investment.

Harris Distributors, located in all principal Cities, are at your service. There's no better time than now to act!

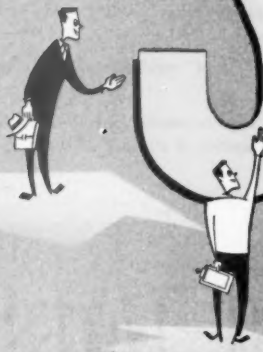
THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

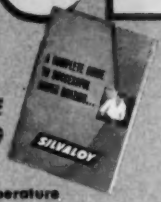
HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

SILVALOY SERVICE



FREE! SEND FOR THIS COMPLETE GUIDE TO LOW TEMPERATURE BRAZING



Leading manufacturers depend upon reliable Silvaloy low-temperature silver brazing alloys and APW Fluxes to be certain of maximum brazing efficiency and low production costs. But that isn't all of it! They also gain "Silvaloy Service," a well-appreciated plus factor that helps to keep brazing production running smoothly and without interruption.

The valuable "Silvaloy Service" features give an important assist to your brazing department. The 3-point program provides a complete range of proper, *proved* alloys for every type of low-temperature silver brazing operation; service and delivery through reliable distributors who warehouse stocks near your plant; PLUS a unique background of silver brazing technical knowledge that is yours promptly, upon request.

Silvaloy technicians are a hand-picked group of top-flight brazing experts. Each man is a qualified authority on practical brazing procedures. He will call at your plant without delay to assist with your brazing problems. Take full advantage of "Silvaloy Service."

SEE SILVALOY WORKING EXHIBIT BOOTH 1972.
NATIONAL METAL SHOW, PHILADELPHIA OCTOBER 20-24TH.

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APW

An inert-gas-shielded metal-arc process

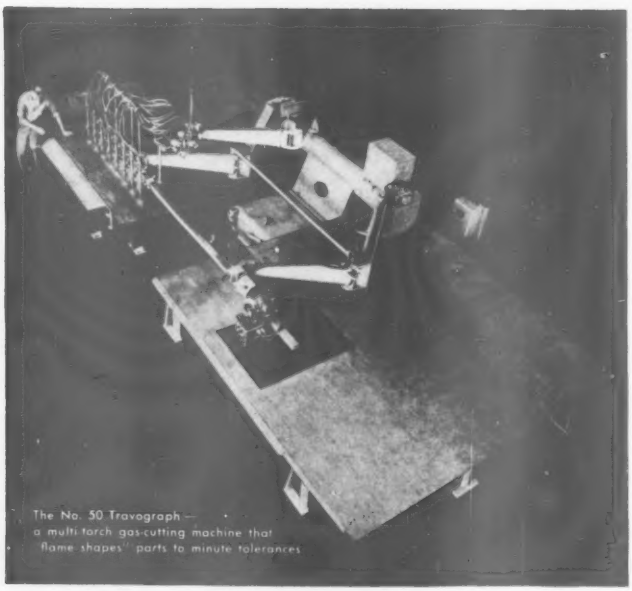
AIRCOMATIC® WELDING

for hard-to-join metals

- Continuous high-rate deposition of filler metal
- Welds aluminum, bronze, nickel, stainless & carbon steels
- No flux required — no slag removal
- Minimum plate-edge preparation
- Heavy section welding with little or no preheat
- No "blind" welding — always a visible arc
- A semi-automatic operation with the versatility of all-position welding

AIRCO

PRESENTS THE LATEST



The No. 50 Travograph — a multi-torch gas-cutting machine that flame-shapes parts to minute tolerances

TRAVOGRAPH® CUTTING

for mass producing intricate shapes

- "Electronic bloodhound" tracing device accurately reproduces template or outline drawings
- Handles light plates, heavy slabs, billets or forgings
- Straight cutting, beveling or squaring
- All-welded construction for durability and precision
- Torch arm will support up to 8 cutting torches
- Precision shapes up to 102" x 144" — circles up to 12' in diameter — with one 16' set of rails. Cutting length extended with additional rail

at CONVENTION HALL in PHILADELPHIA

Airco will bring you an "operators-eye-view" of the Aircomatic welding process . . . a continuous "live" demonstration of the #50 travograph. Here's a rare opportunity to view the latest in welding and cutting equipment! Movies . . . Exhibits . . . Welding Apparatus . . . Stationary and Portable Cutting Machines . . . Gas and Arc Welding Accessories.

IN WELDING AND CUTTING!

SEE 'EM IN ACTION!

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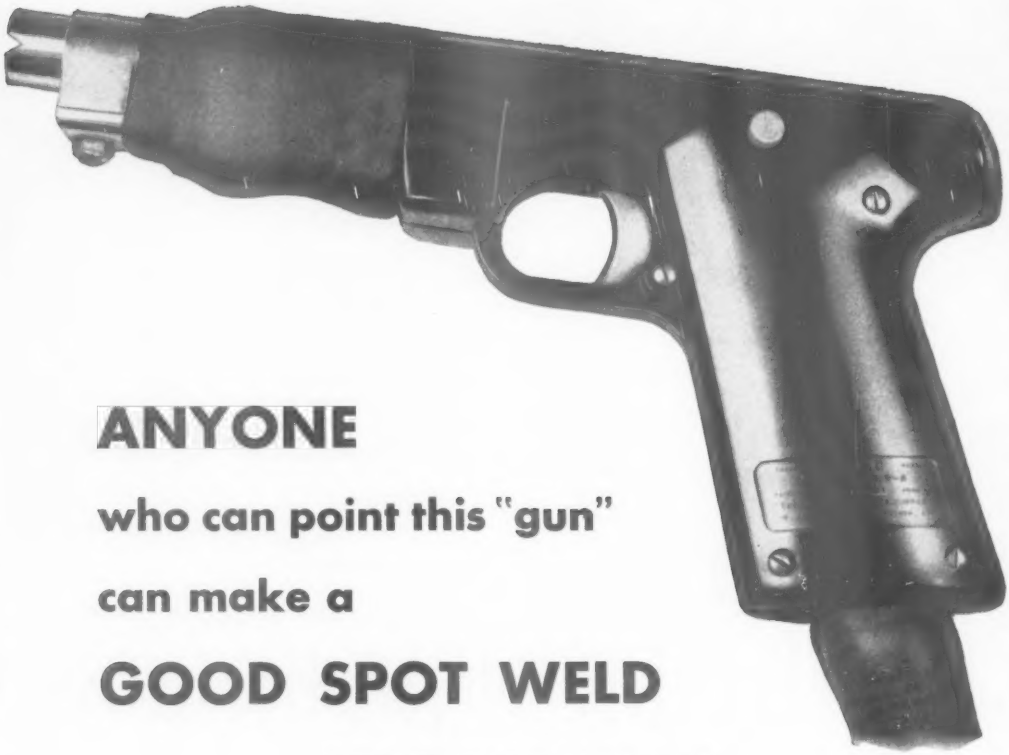
at the frontiers of progress you'll find



ANYONE

who can point this "gun"

can make a

GOOD SPOT WELD

"HELIARC" HW-8 Pistol-Grip Torch needs no forging pressure...works from one side of sheet... spot welds both STAINLESS and CARBON STEELS

Are you using light gage metals to fabricate large assemblies or irregular shapes? If so, chances are you can simplify many of your joining problems, boost production, and cut costs, too, by spot welding with the HELIARC HW-8 Torch.

The HW-8 joins mild steel, low alloy, or stainless steel .020 to .064 in. thick at one to two seconds per weld. Because it works *from one side of the sheet*, without forging pressure, it makes an easy, one-hand job of spot welding — even in places where resistance welding is not practical or possible.

Connected to a suitable power source with auxiliary timer, the HELIARC Spot Welding Torch makes inert gas shielded welds without fumes, smoke, or spatter. Since operation is automatically controlled, workmen on the assembly line need only press the "muzzle" of the "gun" against the work and pull the trigger. A single hose assembly permits free use of the torch over a 25-ft. radius.

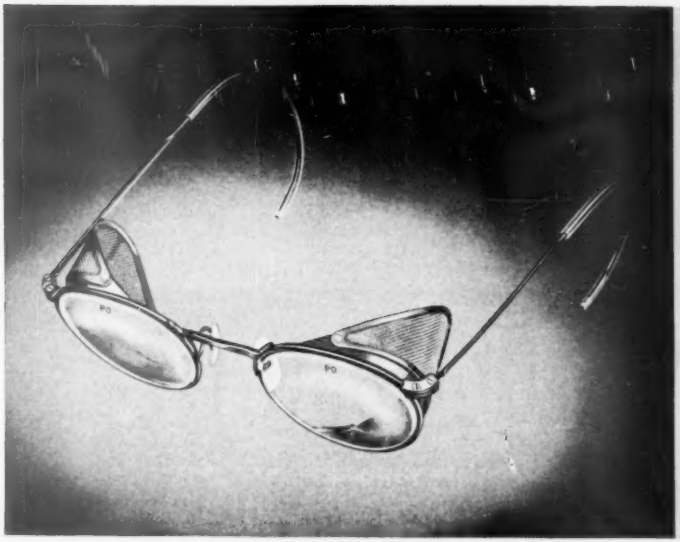
For further information, telephone or write today. LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y.

The term "Heliarc" is a registered trade-mark of Union Carbide and Carbon Corporation.

Linde Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, and FORMING METALS

PENNSYLVANIA OPTICAL COMPANY



ANNOUNCES ITS NEW LINE OF SAFETY GOGGLES!

The 220 Series Goggles

The new 220 Series Goggles are designed to give the utmost in eye protection. Comfort is assured during continued wear by proper balance combined with lightness of weight. This results in worker approval and a higher factor of safety. Varied combinations make these goggles adaptable to many industrial operations requiring positive eye protection.

- ★ Metal construction combines comfort with strength and long life.
- ★ Designed to permit unobstructed side to side vision.
- ★ Heat treated safety lenses, individually tested for impact resistance, and examined for optical perfection.
- ★ Flat or curved lenses—either clear or absorptive green in medium, dark and extra dark shades.
- ★ Many combinations of side shields, lens sizes and bridge widths.

For illustrated folder, containing prices and detailed information, write directly to Pennsylvania Optical Co., Reading, Penna.

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NEW TESTED and PROVED Development...

. . . SOLVES POROSITY Problems in INERT ARC WELDING!

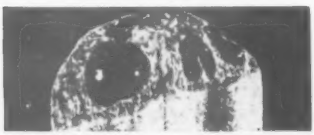
WELDALUMINITE

U.S. PATS. PEND.

The Welding 'Deporosite' That Amazes Industry!

WELDALUMINITE DOES ALL 3:

1. Ends Porosity!
2. Eliminates need for Filler in many Welding Operations!
3. Stabilizes the Arc!



WITHOUT WELDALUMINITE — Photomicrograph of cross-section view of a weld on Rimmed Steel, without the application of WELDALUMINITE. Note the excessive porosity . . . an extremely weak weld . . . will finish poorly.

WITH WELDALUMINITE — Photomicrograph of cross-section view of a weld on Rimmed Steel with the application of WELDALUMINITE. Note the solid, sturdy joint . . . a top quality weld . . . free from porosity.

WELDALUMINITE, the amazing new 'Deporosite', eliminates porosity problems in Inert Arc Welding. Tested and Proved, the use of WELDALUMINITE on Rimmed Steel produces a perfect weld simply and easily . . . the same uniformly fine-grained structure . . . the same sturdy, high-quality welds as obtained with Aluminum "killed" steel!

WELDALUMINITE is specially formulated with Aluminum which deoxidizes the weld pool and retains the Aluminum at the point of welding . . . prevents turbulence caused by gas bubbling through the molten pool . . . stabilizes the arc . . . prevents porosity! Now it is possible to use Rimmed Steel and get consistently perfect welds!

WELDALUMINITE is quickly and easily applied . . . either sprayed or brushed on the joint to be welded and allowed to dry, or may be forced-dried, before welding is begun. No filler is needed in many welding operations.

IMPROVES WELD — SPEEDS WORK — LOWERS COST . . .

In manual operations, electrode manipulation becomes unnecessary due to the deoxidizing action of WELDALUMINITE. In automatic operations, expensive rework time is eliminated.

WELDALUMINITE as a 'Deporosite' and fusing agent has solved porosity problems in Inert Arc Welding of Iron, Steel, Stainless Steel and Nickel. Write us describing your welding problems. *(Our specialists are at your service.)*

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FREE!

Send for your free trial can of WELDALUMINITE. Just state the type of work you are doing for complete instructions in your particular application. *Write today!*

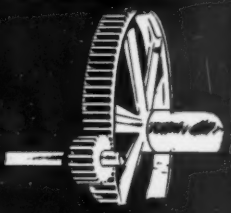
SPEKALUMINITE COMPANY 100 South Water Street, Ossining, N. Y.

Amscoating

The Right Way to Say Hard-facing for every Industrial Use

AMSCO TOOLFACE for metal to metal wear up to 1000° F. Deposits have high abrasion and impact resistance. All diameters bare and coated. Microstructure: martensitic steel.

AMSCO TUBE TUNGSITE (coarse particles) is best suited for applications requiring highly efficient cutting qualities, for hardfacing earth working and drilling equipment used for cutting extremely hard compositions, for hardfacing applications requiring a serrated edge and hard-facing certain types of earth working equipment or parts subject to extreme abrasion.



AMSCO HF-60 for moderate impact and abrasion and has outstanding weldability particularly for vertical applications. All diameters, coated only. Microstructure:, martensitic steel.

AMSCO FARMFACE or AMSCO CHROMEFACE for farm or industrial use. Excellent resistance to low stress sliding abrasion. All diameters, bare and coated. Microstructure: a high chromium austentitic iron containing manganese and silicon, and consisting of hard chromium carbides in a matrix of austenite.

AMSCO No. 217 for abrasive service up to 1000° F. All diameters, bare and coated. Microstructure: an air hardening martensitic iron alloy containing chromium and tungsten.

AMSCO HF-40 for severe abrasion, moderate impact. Deposits have excellent weldability. All diameters, coated only. Microstructure: martensitic cast iron.

AMSCO AIR-HARDENING for abrasion and severe impact. Deposit can be forged to sharp edge without loss of hardness. All diameters, bare and coated. Microstructure: martensitic steel.

AMSCO AW-79 will meet most requirements for better control of wear where abrasion and impact are important factors—plus all the advantages of automatic welding. Especially suitable for rebuilding and hardfacing tractor rollers, steel wheels, sheeting rolls, dredge pins, as well as dozens of other automatic applications. 3/32" and 7/16" in 22½" ID., 100 lb. coils.

AMSCO V-MANG, bare or coated, for build up and repair on manganese steel castings exposed to impact; work hardens—3/32", 7/16", ¼". Microstructure: austenitic manganese steel.

AMSCO CO-MANG, coated only, for build up and repair of manganese steel castings exposed to severe impact. Deposit has excellent impact resistance, work hardens—⅛", 3/32", 7/16", ¼". Microstructure: austenitic manganese steel.

AMSCO TUNGROD (fine particles) is best suited for applications requiring highly efficient cutting qualities, for hardfacing earth working and drilling equipment used for cutting extremely hard surfaces or formations, for hardfacing applications requiring a thin edge or small point, for hardfacing certain types of equipment or parts subject to extreme abrasion.

AMSCO ECONOMY HARDFACE "C" for abrasion resistant service and severe impact. All diameters, coated only. Microstructure: martensitic steel.

AMSCO No. 1 and AMSCO No. 6 for combination of corrosion and abrasion or for 1000° F service and above. No. 1 has greater abrasion resistance; No. 6 is tougher and can be machined. All diameters, bare and coated. Microstructures: No. 6 contains an eutectic carbide mixture in a solid solution matrix, while, No. 1 contains large hard wear-resistant chromium carbide crystals scattered through a solid solution matrix.

AMSCO No. 459 for severe abrasion, mild impact. Excellent abrasion resistance. All diameters, bare and coated. Microstructure: martensitic cast iron containing chromium and molydenum, consisting of hard carbides, austentite and martensite.

To get the right answer, detailed analyses, and other pertinent information, concerning your wear problem, write for catalog 650W or contact your nearest Amsco Distributor.

AMERICAN Brake Shoe COMPANY

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382 EAST 14th STREET · CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que. Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

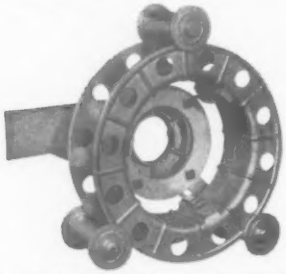
NOW

Double and Triple weight coils for automatic welding with the new REID-AVERY (free wheeling) REELS for Submerged Arc, Open Arc, and Gas Shielded Arc Welding

Raco Reel for 150-200# coils with floor mounting stand.

Decrease down-time by using larger coils. Machines now equipped for 25 lb. coils can use up to 75 lb. coils with these new reels.

These cast aluminum alloy reels ride on ball-bearing trunnions with deep flanges. The wire uncoils with remarkable ease and yet there is no chance of overrunning and throwing loops over the side. No brakes or drags of any kind are necessary. The wire itself prevents overrun. These "free wheeling" reels provide the absolute minimum load on the automatic welding machine.



Raco Reel for 25#-50#-75# coils. Mounted on popular submerged arc machine.

The Reid-Avery reels are available with stands for floor mounting or with special spiders for direct attachment to most popular automatic welding machines. Three reels 12" ID x 4" wide, 14" ID x 6" wide, and 25" ID x 4" wide nominal size are in stock for prompt delivery.

Raco Reel shown split for loading.

Note the simple split reel construction with suitcase type latches. Coils can be replaced in seconds and no wrenches or special tools are required.

We are equipped to supply all sizes of layer wound coils for these reels, for other reels, or on expendable wooden spools where required.

The REID-AVERY COMPANY
INCORPORATED
DUNDALK • BALTIMORE 22 • MARYLAND

SINCE 1919 PRODUCERS OF ARC WELDING ELECTRODES AND WELDING RODS

NOW!

LOOK TO REXWELD HARD SURFACING ROD

IT'S BETTER THESE WAYS:

CUT WELDING TIME

1. Rexweld builds up and holds on an edge better! This means less welding time is required.

INCREASE PRODUCTION

2. Rexweld flows more readily on flat surfaces! In machine gas welding operations valve companies have reported an increase in production per shift using Rexweld.

LESS POROSITY TENDENCY

3. Rexweld has less tendency for porosity because of its smoother flowing and better wetting properties.

BETTER WEARING QUALITY

4. Tests show Rexweld has better wearing qualities.

Hundreds of satisfied users, manufacturing such products as valves, oil pump parts, mixer shafts attest to Rexweld's ability to do a better job . . . at less cost! Rexweld is available in a wide range of grades to meet all requirements. Then too, Rexweld meets Government specifications. If you use hard surfacing rod, be sure you check Rexweld . . . it'll save you time and money.

CRUCIBLE **REXWELD HARD SURFACING ROD**

52 years of Fine steelmaking

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REZISTAL STAINLESS • REX HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

FOR LOW HYDROGEN ELECTRODES

Weldrod coatings with TAM Ruflux T increase the speed with which a slag sets up while providing better slag control. Ruflux T is a compound containing approximately 91.5% ZrO and 5.4% SiO_2. Mesh size is approximately 0.1% on 325 mesh. Detailed information is easily obtained by writing our New York City Office.

*TAM and RUFLUX are registered trademarks.

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Registered U. S. Pat. Off.

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ONE SOURCE

for

EVERY TYPE

of abrasive in high-speed

WELD GRINDING

STRAIGHT WHEELS

CUP WHEELS

RUBBER-BUSHED STRAIGHT WHEELS

"MX" DISCS

MOUNTED WHEELS

CLOTH DISCS

CARTRIDGE ROLLS

CLOTH SLEEVES

used on

EVERY TYPE

of weld grinding and polishing operation

REDUCING WELDS
Straight Wheel

SMOOTHING EDGES
"MX" Depressed Center Wheel or Disc

ROUGH GRINDING
Cup Wheel

ROUGH GRINDING
Rubber-Bushed Straight Wheel

...more proof that

Only CARBORUNDUM

TRADE MARK

offers ALL abrasive products...to give you the proper ONE

"Carborundum" and "MX" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N. Y.

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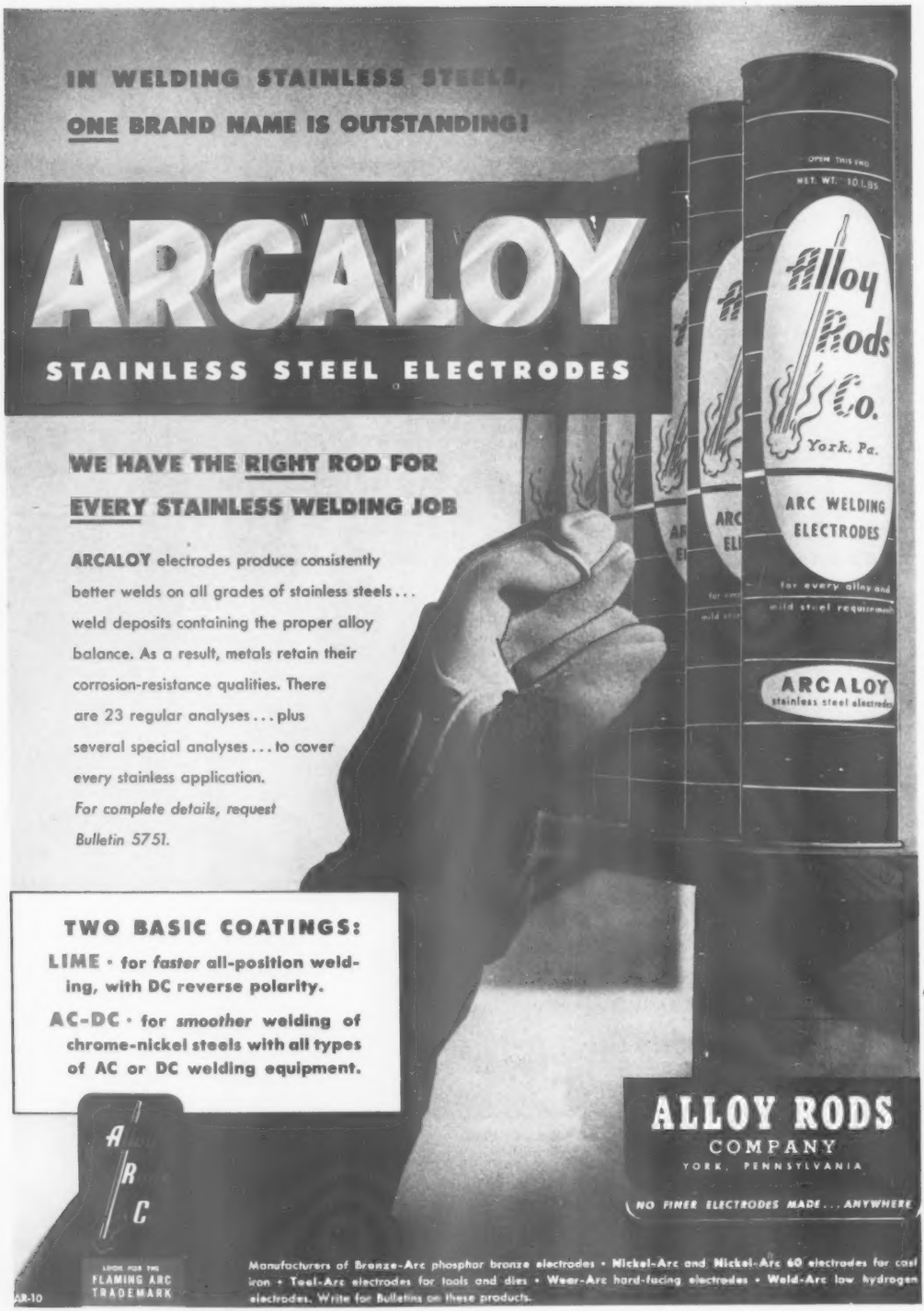
IN WELDING STAINLESS STEELS,
ONE BRAND NAME IS OUTSTANDING!
ARCALOY
STAINLESS STEEL ELECTRODES
WE HAVE THE RIGHT ROD FOR
EVERY STAINLESS WELDING JOB
ARCALOY electrodes produce consistently better welds on all grades of stainless steels... weld deposits containing the proper alloy balance. As a result, metals retain their corrosion-resistance qualities. There are 23 regular analyses... plus several special analyses... to cover every stainless application.
For complete details, request Bulletin 5751.
TWO BASIC COATINGS:
LIME - for faster all-position welding, with DC reverse polarity.
AC-DC - for smoother welding of chrome-nickel steels with all types of AC or DC welding equipment.
Alloy Rods Co.
York, Pa.
ARC WELDING ELECTRODES
ARCALOY
stainless steel electrodes
ALLOY RODS
COMPANY
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NO FINER ELECTRODES MADE... ANYWHERE
A R C
LOOK FOR THE FLAMING ARC TRADEMARK
AR-10
Manufacturers of Bronze-Arc phosphor bronze electrodes • Nickel-Arc and Nickel-Arc 60 electrodes for cast iron • Tool-Arc electrodes for tools and dies • Weer-Arc hard-facing electrodes • Weld-Arc low hydrogen electrodes. Write for Bulletins on these products.

WORLD PREMIERE. Alloy Rods' full color and sound motion picture, "No Finer Electrodes Made . . . Anywhere", at the Metal Show, Philadelphia, Pa., October 20-24, 1952 . . . showing every hour on the hour, Alloy Rods' Exhibit, Booth 448, Arena.

See VIKING *in operation*

Booth 928 — Center Bldg.

34th National Metal Exposition and Congress

OCTOBER 20-24

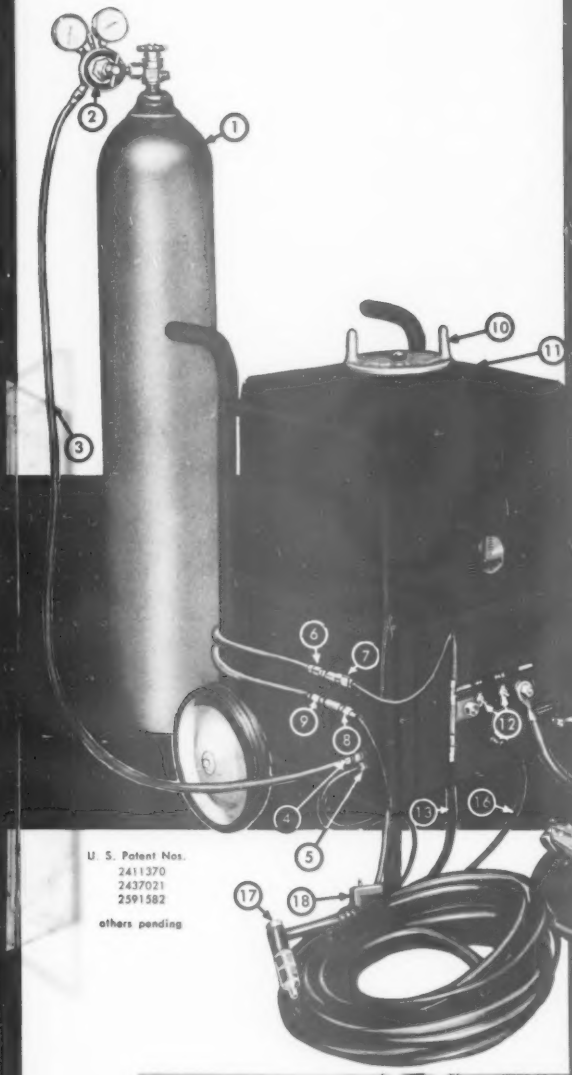
Philadelphia

VIKING

INERT-ARC

WELDERS

VIKING



1. Inert Gas Cylinder
2. Two-Stage Regulator with Liter Gauge
3. Gas Hose to Inlet Connection
4. Gas Inlet to Solenoid Valve
5. Gas Outlet to Torch
6. Inlet from Water Source
7. Water Inlet to Torch
8. Water Outlet from Torch
9. Outlet to Water Drain
10. Amperage Control Wheel
11. Amperage Indicator
12. "On-Off" Switches for
    - High Frequency Circuit
    - Gas Solenoid Valve
13. Torch Electrode Cable
14. Ground Cable with Clamp
15. Surge Resistor Ground Connection
16. Remote Control Cord and Plug
17. Inert-Arc Torch (Air or Water Cooled optional)
18. Remote Control Switch on Torch

U. S. Patent Nos.
2411370
2437021
2591582
others pending

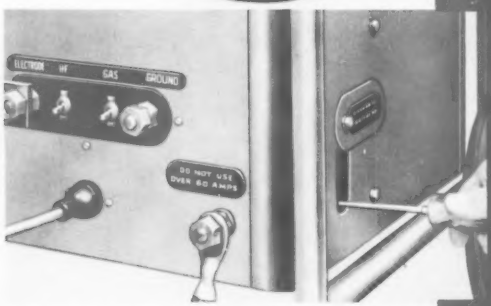
- High Power Factor
- Instant Starting and Stable Arc
- No Objectionable Radio Interference
- Minimum "No-Load" Losses

The inherent design and construction features of VIKING welders bring you these practical advantages:

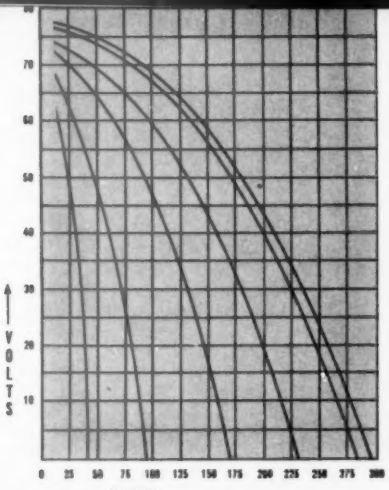
Maximum heat output per amp. through entire welding range results in more inches of weld per minute. Compact construction permits two VIKING machines in floor space usually taken by one welder of conventional design.

Simplified operation from steady, smooth and easy-to-start arc makes all operators skilled in a short time.

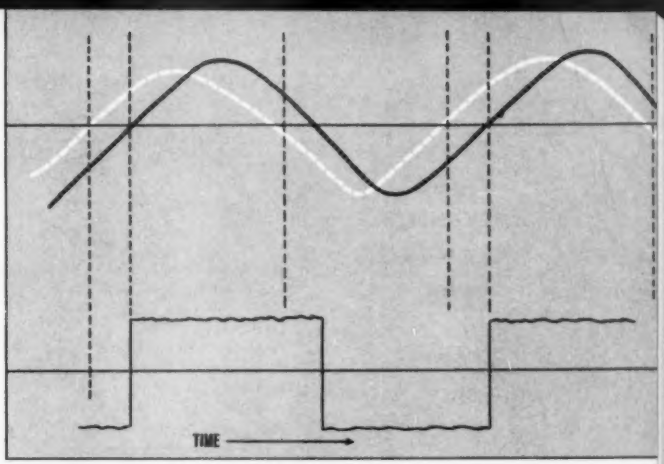
There is a VIKING model to meet the needs for every type of inert-arc welding fabrication. Detailed specifications on all VIKING models are given on page four. Further information, as well as a demonstration may be had from your nearby VIKING Distributor.



Adjustment of spark gap setting for high frequency is easily made as illustrated. One-half turn of setting screws covers the entire range.



Voltage and current relation for different-size air gaps. The open-circuit voltage is virtually constant for all current settings or air-gap openings, no matter how the arc voltage may be varied for welding.



Current and voltage waves as taken from an oscillogram. The phase difference between the secondary open-circuit voltage and the welding current is such that the voltage at the points of zero current is substantially equal to the arc voltage. A steady "balanced wave" arc results at all times.

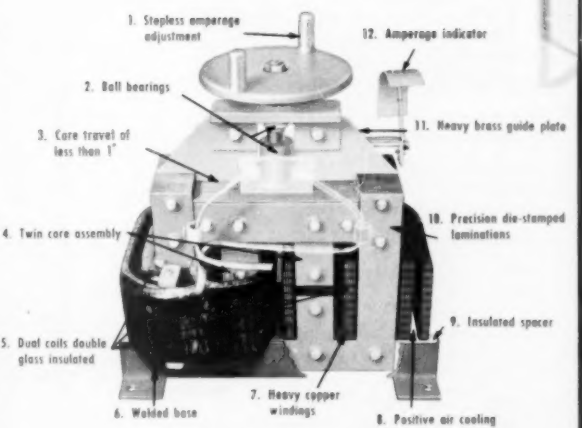
VIKING

- Stepless Amperage Settings
- "Finger-Tip" Control
- Efficient Air Cooling - No Fans
- Arc Boosters and Reactor Coils Not Required
- Advanced Magnetic Circuit Design
- Compact - Really Portable
- Quiet - No Rotary Parts - Vibration Eliminated
- Lowest Possible Maintenance
- Precision Control at All Settings - No "Creeping"

THE HEART OF VIKING INERT-ARC WELDERS

Patented dual-type welding transformer provides a full "balanced wave" arc which results in outstanding performance.

1. Large aluminum handwheel gives ample leverage to easily set amperage at *exact* setting desired.
2. Ball bearing mountings reduce friction to produce smooth action.
3. Travel of the twin core assembly is less than 1" on all models.
4. Twin core assembly is the only moving part—eliminates possible wear and repair.
5. Primary and secondary coils are double wound with glass tape insulation, varnish impregnated and thoroughly baked.
6. Welded base provides rigid construction and permanent alignment.
7. Heavy copper windings provide reserve capacity.
8. Ample air passages dissipate heat for efficient cooling.
9. Insulated tie-rods provide permanent positioning of coils.
10. Cores built up of precision die-stamped laminations of highest quality transformer steel.
11. Heavy brass guide plate is an integral part of the stationary core, providing rigid support for movable core.
12. Amperage indicator is accurately set for direct, easy-to-read amperage settings.


1. Stepless amperage adjustment
12. Amperage indicator
2. Ball bearings
11. Heavy brass guide plate
3. Core travel of less than 1"
10. Precision die-stamped laminations
4. Twin core assembly
9. Insulated spacer
5. Dual coils double glass insulated
7. Heavy copper windings
6. Welded base
8. Positive air cooling

No stray "eddy" currents to cause objectionable radio interference

ADVANCED PERFORMANCE WITH

VIKING

INERT-ARC WELDERS

BUILT-IN POWER FACTOR CORRECTION is provided as standard on all VIKING Inert-Arc Welders. This construction establishes increased electrical efficiency by reducing the KVA demand load and the required primary amperage input.

RAD-ARC-TROL CIRCUIT is built in on all VIKING models for inert-arc welding. This feature guarantees positive and automatic arc starting under all conditions and gives the operator "finger-tip" control at all times. This improved circuit automatically starts the arc without the welding electrode touching the work, fully eliminating tungsten contamination and providing cleaner, better welds.

REMOTE CONTROL OF HIGH FREQUENCY AT TORCH — The control switch is mounted on the torch handle and permits the operator to control the high frequency circuit and the gas flow valve circuit simultaneously. The arc is started by the operator pressing the control button. When the button is released at the finish of the weld bead, the relays controlling the high frequency and gas flow automatically cut off.

REMOTE CONTROL OF HIGH FREQUENCY AND WELDING TRANSFORMER at torch is obtained by operator holding down the control button which in turn closes contactor which operates the primary circuit and the high frequency circuit. After the weld is completed and the control button is released, both the primary and high frequency circuits shut off. Thus, the operator can snuff the arc by pulsation to minimize the formation of weld craters at the ends of the welds.

AUTOMATIC GAS AFTERFLOW standard on all models except CFR, fully protects the tungsten and the weld area against oxidation during the initial cooling-off period.

AIR-COOLED OR WATER-COOLED TORCH optional. When water-cooled torches are used, continuous water flow is provided to keep temperature rise at a minimum.

SELECTOR SWITCHES furnished on VIKING Inert-Arc Welders are as follows:

Model Nos.	High Freq.	Gas	Timer
CFR 15-20-30-40	X		
CRA 15-20-30-40	X	X	
CCA 15-20-30-40	X	X	
CCAT 15-20-30-40	X	X	X

This selection of controls gives complete flexibility to fully meet individual job requirements, as it permits the use of various arc welding processes with or without high frequency current. All VIKING models listed may be used for straight metallic-arc welding using all types of coated electrodes.

SPOT ARC TIMER. VIKING "CCAT" models are equipped with an automatic timer for spot-arc welding operations. Welding cycle interval is easily adjusted from approximately 1/10 second to 6 seconds. The remote control switch on the torch is used to start the welding cycle and gas flow. The arc is shut off by the timer circuit after the pre-set weld time has elapsed.

	VIKING MODEL NUMBERS			
	15 CFR 20 CFR 30 CFR 40 CFR	15 CRA 20 CRA 30 CRA 40 CRA	15 CCA 20 CCA 30 CCA 40 CCA	15 CCAT 20 CCAT 30 CCAT 40 CCAT
Built-In Power Factor Correction	X	X	X	X
Built-In High Frequency	X	X	X	X
Remote Control of High Frequency at Torch	X	X	X	X
Remote Control of Primary Circuit Contactor at Torch			X	X
Automatic Gas Control		X	X	X
Automatic Gas After-Flow		X	X	X
Spot Arc Timer				X

VIKING INERT ARC SPECIFICATIONS

VIKING INERT ARC MODEL	WELDING RANGE	RATED AMPERAGE	PRIMARY AMPS. AT RATED LOAD 220V	PRIMARY AMPS. AT RATED LOAD 440V	KVA AT RATED LOAD	DUTY CYCLE AT RATED LOAD
15 CFR 15 CRA 15 CCA 15 CCAT	10-200 amps	150 @ 25v	45	23	9.9	35%
20 CFR 20 CRA 20 CCA 20 CCAT	20-275 amps	200 @ 30v	65	33	14.3	50%
30 CFR 30 CRA 30 CCA 30 CCAT	35-400 amps	300 @ 40v	95	48	20.9	60%
40 CFR 40 CRA 40 CCA 40 CCAT	60-525 amps	400 @ 40v	120	60	26.4	60%

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VIKING WELDING PROCESS EQUIPMENT

Form 101

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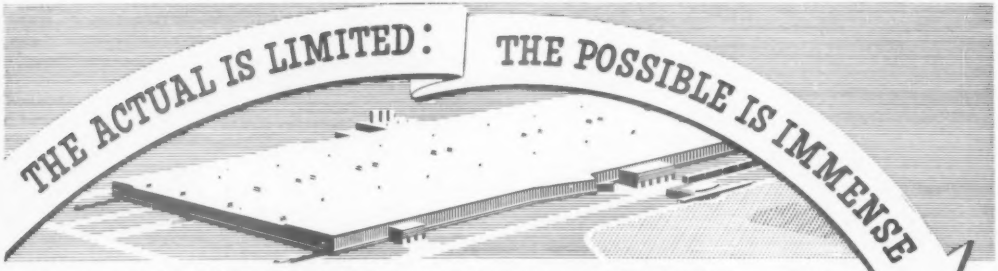

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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...cuts weight 36%, lowers cost 45%

By **A. H. Hallenbeck,** Plant Manager
Gifford Wood Company, Hudson, New York

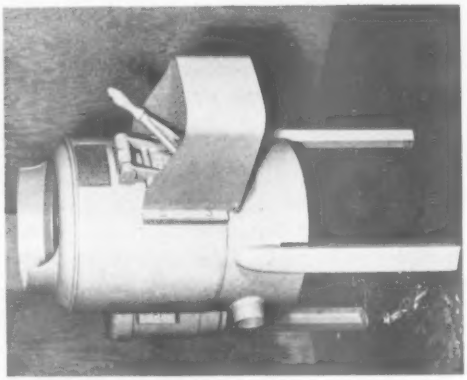

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Fig. 3 — Food processing machine *for the Gifford Wood Company, Hudson, New York. Streamlined appearance is simple to maintain, easy to clean.*

WELDED DESIGN ALWAYS SAVES STEEL AND LOWERS COST

Fig. 1—Original Construction—*Base for processing machine. Weighed 67 pounds. Material Cost—$15.05; Machining Cost—$7.34. Total Cost $22.39.*

Fig. 2—Present Welded Steel Design—*Stronger, more rigid. Weighs only 43 pounds. Material Cost $2.50; Fabrication—$9.77. Total Cost—$12.27.*

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ESTABLISHED 1916

THE WELDING ENGINEER

OCTOBER, 1952

The Story of Stainless Steel

FOR THE first time in our 37 years of publishing, we are devoting most of the editorial content of an issue of THE WELDING ENGINEER to a single subject. On the pages that follow you will find a comprehensive series of articles on the fusion welding, brazing, resistance welding, preweld and postweld cleaning, grinding, polishing and cutting of stainless steel.

Stainless steel, welding and THE WELDING ENGINEER all came into being about the same time —1916. Credit for the first practical commercial stainless steel is generally given to Harry Brearley, a metallurgist of Sheffield, England, who was granted a patent in 1916 for an iron-chrome alloy containing around 13% chromium. Brearley's alloy was the same as today's type 420, a martensitic (hardenable) chromium-iron without nickel.

Brearley's employers were cutlery makers (Sheffield was and still is noted for its fine cutlery), so it was only natural that the first commercial stainless steel was employed for tableware. For a long time, when you thought of stainless steel, you thought in terms of knives and forks and spoons.

The austenitic stainless steels — the alloys of nickel-chromium-iron—are another story. It is hard to say whether the credit for their discovery must go to a Frenchman or a German. In 1906, Leon Guillet, in France, published a detailed study of the basic metallurgical characteristics. Patents were granted, however, for commercial steels developed by E. Maurer, of the research department of Germany's Krupp steel plant, during the period from 1909 to 1912. One of these alloys was practically the same as the familiar 18-8 stainless of today.

THE DISCOVERY of stainless steel is thus divided among several claimants. This much, however, is certain: stainless steel, welding and THE WELDING ENGINEER have all grown up together. Furthermore, it was not until satisfactory methods had been developed for welding them that the stainless alloys began to receive widespread acceptance by industry.

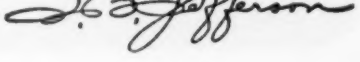
As one example, we cite the food-processing industry. The quality of resisting corrosion has made stainless-steel equipment popular in this industry for sanitary reasons. Before the vessels and piping were welded, however, each joint and each screwed fitting provided cracks for lurking bacteria. Welding eliminated the bacteria breeding grounds by doing away with all cracks and crevices. When proper grinding and finishing techniques are followed, it becomes impossible to determine just where the weld has been made. In effect, the welded fabrication has become one piece of metal—an easily cleaned, sanitary, shining, spotless piece of equipment.

AN ALMOST equally important application is for conditions of high temperature (also low temperature) and high pressure. The combination of great strength, work-hardening characteristics and ability to resist oxidation and scaling at elevated temperatures has rendered the austenitic stainless steels, in particular, of great value for these exacting services.

The production of stainless steel has grown from the nothing of 1916 to nearly 900,000 tons in 1950. During the past year-and-a-half, production of austenitic alloys has been curtailed because of the critical shortage of nickel. This has resulted in a noticeable upswing in the production of the martensitic and ferritic alloys (notably type 430), which contain little or no nickel.

Recent years have likewise seen a continual growth in the production of stainless-steel electrodes. Last year close to 20,000,000 pounds of stainless electrodes were manufactured. Many thousand pounds of such electrodes are currently being consumed in the welding of armorplate on tanks and other items of military equipment.

The fabrication of stainless steels is tricky—there are many problems in assembly, welding and finishing that still baffle the fabricator. So that users of welding everywhere may become better informed, we present The Story of Stainless Steel. We think that we have done a good editorial job; however, we would like your comments.



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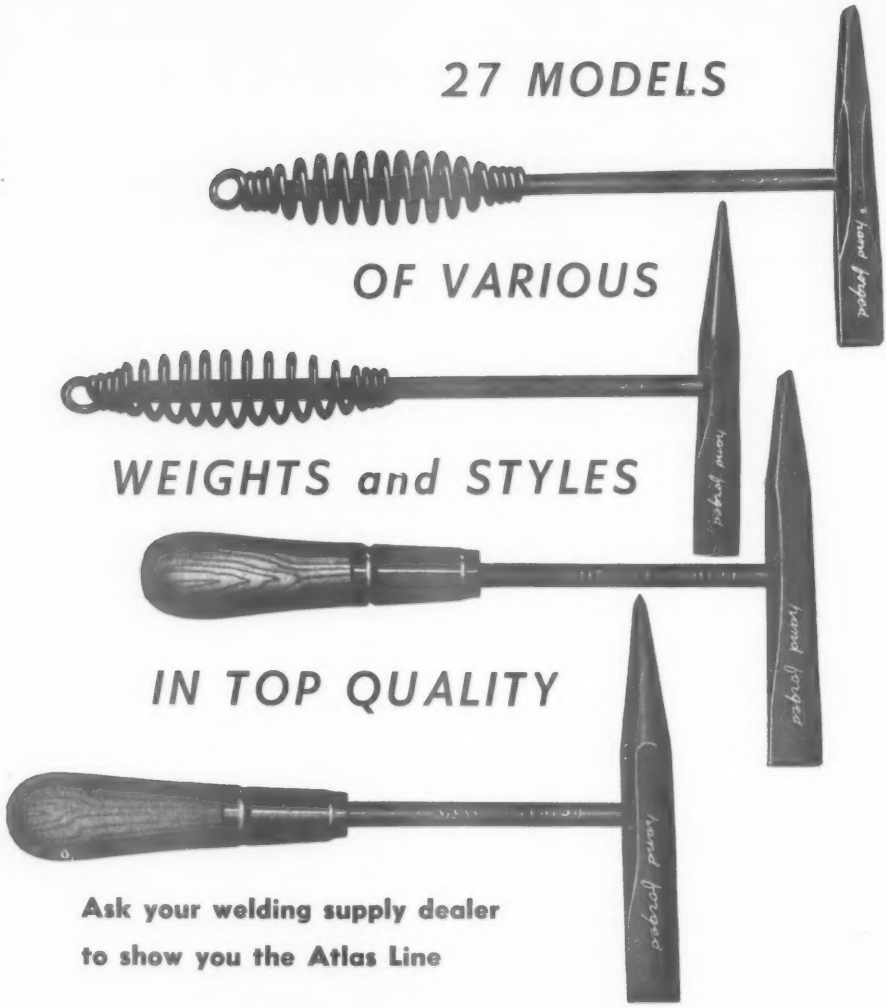

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STAINLESS sheets are inert-arc welded to make a storage cooler at the Cherry-Burrell Corp., Little Falls, N. Y.

How to Weld Stainless Steels

Table I. Here are the Chemical Ranges of Stainless and Heat-Resisting Steels

	Type	Carbon	Manganese	Silicon	Phosphorous	Sulfur	Chromium	Nickel	Other Elements
AUSTENITIC	301	Over 0.08 to 0.20	2.0 max.	1.0 max.	0.04 max.	0.03 max.	16.0/18.0	6.0/ 8.0	....
	302	Over 0.08 to 0.20	2.0 max.	1.0 max.	0.04 max.	0.03 max.	17.0/19.0	8.0/10.0	....
	302B	Over 0.08 to 0.20	2.0 max.	2.0/3.0	0.04 max.	0.03 max.	17.0/19.0	8.0/10.0	....
	303	0.15 max.	2.0 max.	1.0 max.	*	*	17.0/19.0	8.0/10.0	*P or S or Se—0.07 min.; Zr or Mo—0.60 max.
	304	0.08 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	18.0/20.0	8.0/11.0	....
	305	0.12 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	17.0/19.0	10.0/13.0	....
	308	0.08 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	19.0/21.0	10.0/12.0	....
	309	0.20 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	22.0/24.0	12.0/15.0	....
	310	0.25 max.	2.0 max.	1.5 max.	0.04 max.	0.03 max.	24.0/26.0	19.0/22.0	....
	314	0.25 max.	2.0 max.	1.5/3.0	0.04 max.	0.03 max.	23.0/26.0	19.0/22.0	....
	316	0.10 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	16.0/18.0	10.0/14.0	Mo—2.0/3.0
	317	0.10 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	18.0/20.0	11.0/14.0	Mo—3.0/4.0
	321	0.08 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	17.0/19.0	8.0/11.0	Ti—5xC min.
	347	0.08 max.	2.0 max.	1.0 max.	0.04 max.	0.03 max.	17.0/19.0	9.0/12.0	Cb—10xC min.
MARTENSITIC	403	0.15 max.	1.0 max.	0.5 max.	0.04 max.	0.03 max.	11.5/13.0	....	....
	410	0.15 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	11.5/13.5	....	....
	414	0.15 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	11.5/13.5	1.25/2.5	....
	416	0.15 max.	1.25 max.	1.0 max.	*	*	12.0/14.0	....	*P or S or Se—0.07 min. Mo or Zr—0.60 max.
	420	Over 0.15	1.0 max.	1.0 max.	0.04 max.	0.03 max.	12.0/14.0	....	....
	431	0.20 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	15.0/17.0	1.25/2.5	....
	440A	0.60/0.75	1.0 max.	1.0 max.	0.04 max.	0.03 max.	16.0/18.0	....	Mo—0.75 max.
	440B	0.75/0.95	1.0 max.	1.0 max.	0.04 max.	0.03 max.	16.0/18.0	....	Mo—0.75 max.
	440C	0.95/1.20	1.0 max.	1.0 max.	0.04 max.	0.03 max.	16.0/18.0	....	Mo—0.75 max.
	501	Over 0.10	1.0 max.	1.0 max.	0.04 max.	0.03 max.	4.0/ 6.0	....	....
	502	0.10 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	4.0/ 6.0	....	....
FERRITIC	405	0.08 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	11.5/13.5	....	Al—0.10/0.30
	430	0.12 max.	1.0 max.	1.0 max.	0.04 max.	0.03 max.	14.0/18.0	....	....
	430F	0.12 max.	1.25 max.	1.0 max.	*	*	14.0/18.0	....	*P or S or Se—0.07 min. Mo or Zr—0.60 max.
	446	0.35 max.	1.5 max.	1.0 max.	0.04 max.	0.03 max.	23.0/27.0	....	Nitrogen—0.25 max.

Courtesy, Steel Products Manual, Section 24, Stainless and Heat-Resisting Steels, American Iron and Steel Institute.

How to Weld Stainless Steels

Here's helpful information for you! This comprehensive article covers all processes of fusion welding for the chrome-nickel and straight-chromium steels.

BY LESTER F. SPENCER
Chief Metallurgist
Landers, Frary and Clark

WHEN you talk of "stainless steel," it is necessary to define your terms. The Steel Products Manual of the American Iron and Steel Institute, Section 24, lists 36 compositions as of August, 1952, each representing a terrific amount of research and development. Table I (preceding page) gives chemical ranges and limits for 29 of the most commonly encountered compositions.

To find your way through this jungle, you must know the beaten paths. There are three essential divisions: the austenitic, the martensitic and the ferritic alloys.

The 14 austenitic alloys shown in Table I are all members of the 300 series. These alloys contain both chromium and nickel and are highly resistant to both heat and corrosion. More about them later on.

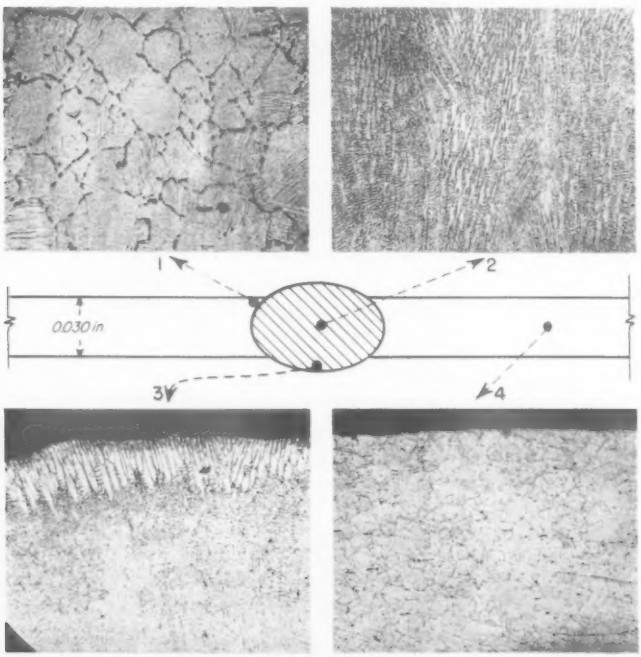
Of the 11 martensitic alloys, nine are in the 400 series and two in the 500 series. Only two of the martensitic alloys contain nickel (414 and 431) and then in relatively small amounts, 1.25-2.5%. This group is characterized by its response to heat treatment when subjected to the normal heat-and-quench procedure employed for carbon steels.

The four ferritic stainless steels are all in the 400 series. These alloys do not contain nickel. They are low in carbon, high in chromium and are characterized by the retention of ferrite (pure iron) upon cooling from high temperatures. Let's now look at each of these basic groups in greater detail.

The chrome-nickel austenitic alloys are non-magnetic and non-hardenable by a standard heat-and-quench procedure. They can, however, be cold worked. To secure better properties such as corrosion resistance, weldability, physical strength, etc., other alloying elements are added besides chromium and nickel.

Types 316 and 317 stainless contain molybdenum (2-4%), an addition that materially increases corrosion resistance. Type 321 contains titanium and type 347 has columbium, purpose of which additions is to overcome the harmful carbide precipitation so characteristic of the other stainless compositions. Type 303 stainless is the free machining grade and contains phosphorous or sulfur or selenium to assist machining.

The higher-alloyed austenitic stainless steels, such as types 309 and 310, are primarily heat-resistant grades; the chromium content is sufficiently high to obtain resistance to scaling up to approximately 2,000 F, and the nickel content is sufficient to keep the alloy in an austenitic condition. Type 310 is usually preferred since the lower coefficient of expansion of this alloy tends to produce a more stable scale formation during high-temperature service.



1—JOINT DESIGN for metal-arc welding of type 304. The four microphotographs show grain structure at the various areas indicated by dots

MARTENSITIC AND FERRITIC

The martensitic alloys are the heat-treatable group. This group can be further classified as to hardenability in accordance with the carbon and chromium contents. Thus types 420, 440A, 440B and 440C are excellent steels where a high hardness within a heat-treated section is desired. The martensitic alloys realize their maximum corrosion resistance only after they are in the heat-treated state. Unlike the austenitic alloys, they are magnetic.

The ferritic stainless steels are also magnetic. Chromium contents vary from 11.5-13.5% up to 23.0-27.0%. The high chromium alloy, type 446, is the heat-resistant alloy within this group; the maximum temperature at which it will resist excessive oxidation is 2,100 F. However, during any heating cycle, care must be taken to avoid any loss in toughness. Thus heating this alloy in the range of 700-1,450 F results in lowering of the impact toughness, while heating it in the vicinity of 1,800 F results in grain growth and a loss of ductility.

The weldor of stainless steels must concern himself with the corrosion

resistance exhibited by the weld area. It is the intention of this article to bring out certain pertinent facts that will aid him in joining a stainless-steel composition.

Why Corrosion Resistance?

The stainless steels resist corrosion by the formation of an oxide film that prevents further attack. A 12% chromium within the composition is sufficient to resist normal atmospheric corrosion. As conditions of service become less oxidizing, however, successively higher chromium is required in order to promote the formation of this protective film. Let us take a given set of corrosive conditions and increase the chromium content gradually. Resistance to attack does not increase gradually but occurs abruptly[2] at the chromium content sufficiently high to allow the formation of a protective film. The addition of nickel improves the stability of this protective film, without any discoloration on the surface of the metal, and makes its formation much easier.

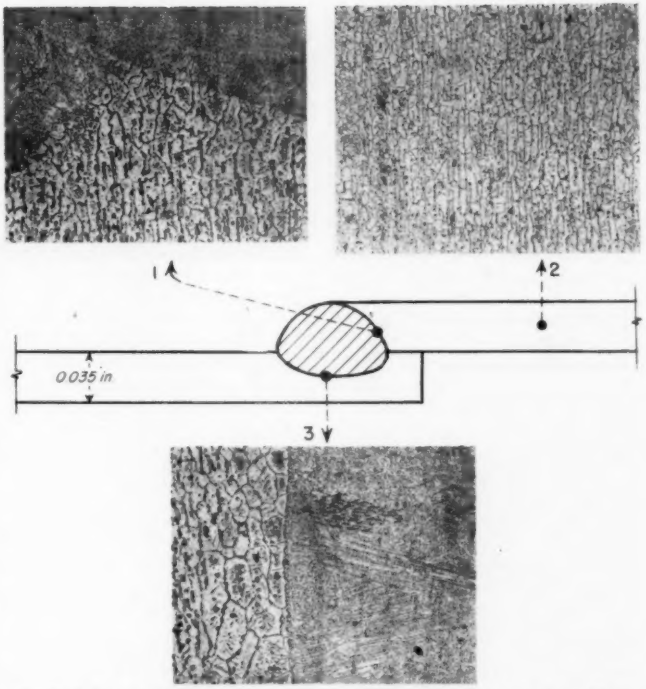
The behavior of the stainless steels under the influence of heat may best be realized by comparing them with ordinary carbon steel. Thus:[1]

(1) The coefficient of the chromium-nickel alloys is about 50% greater than plain steel; that of the straight-chromium type is about the same as, or slightly less than, plain steel.

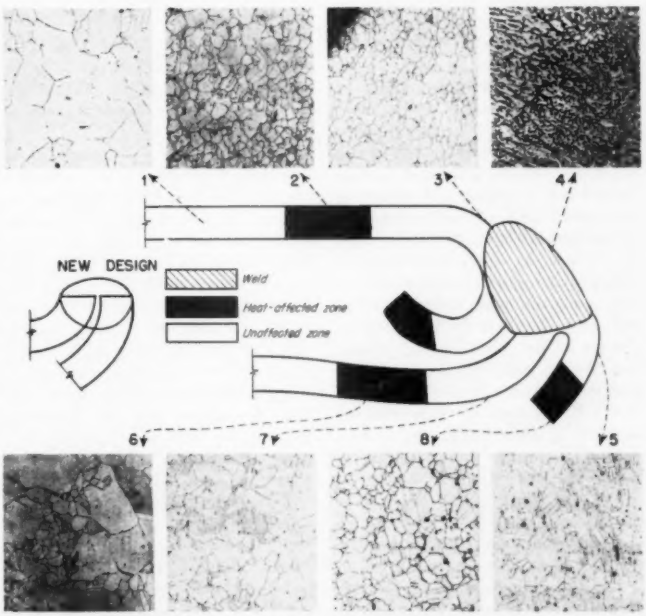
(2) The chromium-nickel alloys conduct heat 40 to 50% as fast as plain carbon steel. The straight-chromium types conduct heat from one-half to two-thirds as fast as plain steel. To put it another way, these stainless steels retain heat for a longer period of time because it is not conducted away as fast.

(3) The electrical resistance of the chromium-nickel alloys is about six times that of plain steel, increasing to twice that amount when the alloy is extremely cold worked. Electrical resistance of the straight-chromium alloys varies from three to six times that of plain steel.

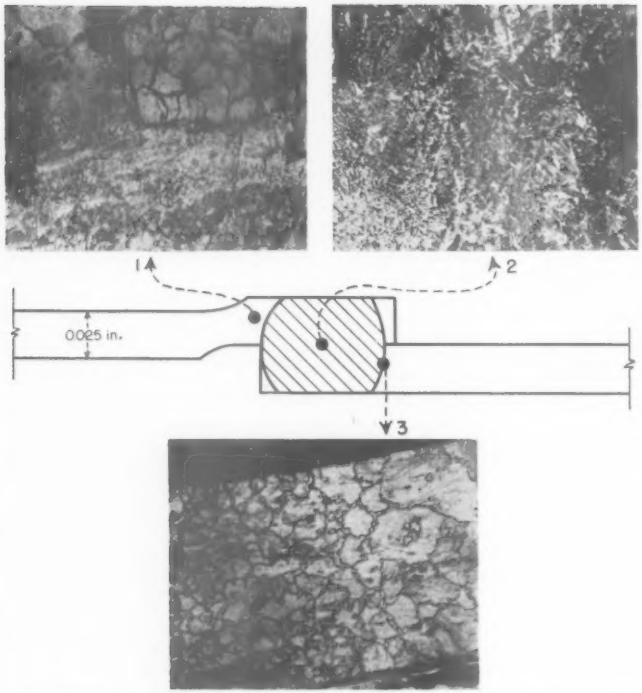
(4) The melting points of all stainless steels are slightly lower than that of ordinary steel, and both the chromium-nickel and the straight-chromium types are much more fluid in the melted state. As compared to plain carbon steels, less heat is required to melt the stainless steels.



2—LAP joint in 321 titanium-stabilized stainless. Microphotos at positions 1 and 3 are at the weld border; at position 2 in the unaffected metal



3—COMPLICATED joint for inert-arc welding with microphotos to show structure at eight positions. Design was later revised as per left sketch



4—JOINT for type 430 (straight-chromium ferritic alloy). Grain growth in heat-affected areas near weld (positions 1 and 3) gradually decreases

Welding Characteristics

The chromium-nickel (austenitic) alloys are more readily and satisfactorily welded than the straight-chromium compositions. The welded joints are strong, ductile and tough in their "as-welded" condition and require no subsequent heat treatment or annealing to improve their physical properties. Upon the application of heat, however, a carbide precipitation occurs along the grain boundaries that will seriously affect the corrosion resistance of the joint. These precipitated carbides will vary in accordance with the following factors:

(1) The longer the time that the material is held within the carbide precipitation range (800-1,500 F), the greater the percentage of carbides.

(2) The closer the temperature of the affected areas is to 1,200 F, the greater the amount of intergranular carbides present.

(3) Chromium-nickel steels with higher carbon are more susceptible to the formation of these carbides than steels of lower carbon.

(4) The greater the combined chromium and nickel in proportion to the amount of carbon in the analysis, the less rapid will be the formation of carbides.

Annealing: One of the most obvious remedial treatments is to re-dissolve the carbides in solid solution by annealing the welded structure. This annealing treatment consists of heating to a temperature range of 1,850-1,950 F, followed by a sufficient soak period to effect the re-dissolving of the carbides and then by a rapid quench. The carbides will reappear, however, if service requirements include exposure to temperatures within the carbide formation range. Also, full annealing followed by a drastic quench may cause considerable distortion in the finished welded part.

Less carbon: Another remedy is to reduce the carbon content within the alloy so that a minimum of carbides will develop. Recently, a very low-carbon stainless steel has been widely publicized; this composition contains a maximum of 0.02% carbon. The standard type 304, which has a maximum carbon of 0.08%, may also be employed.

In this connection, an electrode having a carbon content between 0.05 and 0.07% will minimize carbide precipitation. Stabilization of the alloy for welding by the adjustment of the carbon, chromium and/or nickel content is considered effective only in thicknesses up to approximately 7/16 in.[7]; greater thicknesses of material must be stabilized.

Stabilizing: The addition of either columbium or titanium to a standard austenitic composition, types 321 and 347, will prevent the formation of harmful carbides by forming other types of carbides that are not harmful. Neither the columbium nor the titanium carbides will affect the corrosion resistance of the weld. Use of a stabilized stainless is a must for applications where the operating service is within the critical temperature range; *i. e.*, 800-1,500 F.

In the welding of the stabilized steels, columbium-bearing electrodes are used exclusively since 70 to 75% of the columbium in the rod is transferred to the weld deposit and adjoining areas to protect the weld from harmful intergranular carbides. Titanium-bearing electrodes are not recommended because approximately 85% of the titanium is lost, and the remaining 15% is not sufficient to protect the weld and the heat-affected zone from the formation of carbides.

What Happens at the Weld

In the arc welding of type 304 stainless steel, a metallographic investigation of the weld resulted in the four photomicrographs reproduced in Fig. 1. The original micrograph in position 1 had a magnification of 375X; the other three were 125X. Some harmful carbides are in evidence in the heat-affected zone, position 1, but these are mostly scattered and do not form a continuous chain. These carbides would not present too much of a problem for the application involved. Position 2 illustrates the typical acicular (needlelike) weld structure, and position 3 reveals that some loss of carbon is realized at the very top of the weld deposit. For comparison, position 4 shows the unaffected metal.

It has been our experience that in applications where severe corrosive conditions are not encountered, the

scattered carbides will have no effect on the serviceability of the product. Where service requirements are such that even scattered carbides will prove harmful, it is wise to use a stabilized stainless.

For comparison, Fig. 2 shows a metallographic survey of an arc weld in type 321 steel (titanium stabilized), for which a columbium-stabilized electrode was used. The carbides are absent; however, some grain growth did occur within the heat-affected zone, positions 1 and 3. Position 2 illustrates the normal structure, indicating prominent ferrite banding. All micrographs had a magnification of 125X.

Of equal interest is a survey of an inert-arc welded joint in type 302 stainless. The weld was performed manually, using a tungsten arc and a filler rod. The eight micrographs of Fig. 3 had a magnification of 375X. Though the outside of the weld was mechanically perfect, the micrographs reveal heavy carbide areas in the heat-affected zones, positions 2, 6 and 8. Tests indicated that the corrosion resistance of these areas was affected. This was unsatisfactory. The remedy was a redesign and simplification of the joint as shown by the sketch on the left. The redesign permitted the fusion of the joint without filler rod, which minimized the carbide zones by increasing the speed of welding.

Figure 4 shows a survey of an inert-arc weld in one of the ferritic alloys, type 430. This weld is of interest because of the present necessity for substituting the nickel-free type 430 for type 302 stainless in many applications. Grain growth in areas adjoining the weld (positions 1 and 3) gradually decreased in the weld area (position 2). The magnification was 125X for all three micrographs.

It is of interest to learn that a titanium-stabilized type 430, known as 430T, is available for welding applications; this analysis has from 0.30 to 0.70% titanium.

The welding speed of the weld in Fig. 4 was approximately 19 linear feet per minute. The application is such that no shock or deformation will be experienced, and it is believed that the weld in Fig. 4 will be perfectly satisfactory. However, an investigation on the use of titanium-stabilized type 430T stainless is in progress.

Welding Straight-Chromium

The straight-chromium stainless steels, the martensitic and the ferritic compositions, are considered stable at all temperatures. They do not suffer a loss of corrosion resistance as a result of being heated to the temperatures experienced in welding.

The martensitic stainless alloys are air hardening and are characterized by both high hardness and brittleness within the zone of welding after joining has been completed. The degree of air hardening will fluctuate with the carbon content. Regardless of carbon, however, the weld can be made quite ductile by permitting a full anneal directly after welding. A slow cool from the annealing temperature is mandatory.

For better welding, it is suggested that a preheat be employed at 300-400 F, the latter temperature being preferred. For maximum corrosion resistance (equivalent to that of the base metal), the chromium content of the weld should be as high as that within the parent metal. If maximum toughness is desired, the chromium content should be held as low as possible. In either case, the variation should not be more than 1%.

The effects of heat upon the straight-chromium stainless steels are tabulated in Table II.[1]

The straight-chromium ferritic alloys may be fusion welded by almost any of the methods recommended for mild steel with the exception of forge or hammer welding. Sound welds can be produced insofar as fusion and lack of porosity are concerned; however, there will be a loss of ductility in both the weld and the heat-affected zones due to the coarse crystalline structure that is obtained at the high welding heat. This loss of ductility is most evident at room temperatures and, as a result, fusion welding is not

Table II. Effects of Heat on the Straight-Chromium Stainless Steels

Property	*4-14% Chromium*	*14-18% Chromium*	*18-30% Chromium*
Corrosion resistance	Not susceptible to loss of corrosion resistance through intergranular carbide precipitation. For best properties, should not be heated over 1,600 F.		
Hardening properties	Harden when cooled in air from high temperatures	Behavior depends upon relation between chromium and carbon contents	Do not harden, even when cooled rapidly
Ductility	Decreased by welding; improved by heat treatment	Behavior depends upon relation between chromium and carbon contents	Reduced by welding; improved by annealing
Response to heat treatment	Wide range of mechanical properties obtainable	Behavior depends upon relation between chromium and carbon contents	No range of properties obtainable by heat treatment
Grain of metal	Weld deposit laid down above melting temperature tends to grow large grain upon cooling. Large grain size in adjacent metal increases with application of heat		
Coefficient of expansion	Same or slightly less than that of plain carbon steel		
Heat conductivity	Varies from 70 to 40% of common steel, depending on chromium content		
Electrical resistance	Varies from 3 to 6 times that of plain carbon steel, depending upon the chromium content		
Melting point	Slightly less than that of plain carbon steel		

recommended where the welded part is to be subjected to either deformation or shock. The ductility of the fusion weld will increase rapidly upon the application of heat, and it is quite ductile at temperatures above 400-500 F. This means that at elevated temperatures, fusion-welded joints in, say, type 430 stainless have a better ability to withstand stresses and strains; this fact is being used to advantage in numerous applications. If the welded structure is maintained in the range of 750-1,100 F for an extended period of time, the welds are likely to be quite brittle when cold.[10] Full ductility can be restored by heating to 1,400-1,500 F, followed by a rapid cool.

Where filler rods are employed in the welding of the ferritic alloys, the chemical composition of the welding rod should either be of the same composition as the parent metal or else have a slightly greater chromium content. Employment of an austenitic rod such as an 18-8 or 25-12 type will result in more ductile welds, but a price must be paid for this ductility. The coefficient of expansion of the weld will differ considerably from that of the parent metal, which may cause ultimate failure if the joint is repeatedly heated and cooled.

Courtesy Cherry-Burrell Corp.

POSITIONERS and jigs to hold the exact alignment are probably more important to stainless steel than they are in the welding of mild steel

Manual Arc Welding

DIRECT current is generally preferred to alternating current in the metal-arc welding of the stainless steels. Reversed polarity is preferred over straight polarity, although the latter may be used in the welding of heavy-gage plate. Lime-coated electrodes employing reverse polarity are recommended; these result in less cracking in joints that are highly stressed or in the welding of material that has high hardenability. Coated electrodes should be stored where both temperature and humidity is under control so as to prevent the absorption of moisture by the coating. A difficulty associated with the use of lime-covered rods[2a] is that of slag removal in confined joints or small fillets.

A recently developed electrode can operate either on a-c or d-c; its manufacturer claims that a better appearing deposit is obtained, a more uniform action during welding is realized and that the electrode is easier to handle than lime-covered electrodes. The exact composition of the coating is not known; however, it contains lime as the base.

In order to prevent any loss of valuable alloys through volatilization, the chromium content of an austenitic electrode should be within the range of 19.0 to 21.0%. To minimize any tendency toward cracking, it is also recommended[6] that the chromium content of the electrode be at least twice the nickel content. The loss of columbium and titanium have already been discussed, and no appreciable loss in either nickel or molybdenum is experienced in transferring across the arc. The control of carbon[1] within the weld deposit is obtained through: (1) use of low-carbon rods and (2) by avoiding electrodes that have carbonaceous material in the coating.

In metal-arc welding, the current is adjusted to provide heat just sufficient to insure good fusion; the welding machine should be provided with quick, accurate adjustment and control of current additions.

Recommended conditions of amperage and voltage for metal-arc welding of the austenitic stainless steels are given in Table III.[8]

WELDING TECHNIQUE

It is recommended[1] that the gap between the rod and the work be short; this gives the most uniform results, permits better control of the weld deposit and provides for adequate flux protection of the weld. Weaving should be avoided since it may produce slag entrapment; however, weaving cannot be avoided where wide beads are deposited. As a general rule,[1] the more quietly the molten metal can freeze or solidify under its protective blanket of slag, the more sound and homogeneous the resulting weld deposit will be.

It is necessary to clean the area where welding will be performed; this is very important in the welding of the austenitic stainless. Scale, dirt, grease or other carbonaceous contamination should be removed not only from the work but also from surrounding jigs, fixtures and welding table. Needless to say, the edges to be welded should be accurately aligned and rigidly held so that the weld metal can be deposited without interruption.

TYPES OF JOINTS

The choice of joint depends upon the thickness of material to be weld-

Table III. Metal-Arc Welding of Austenitic Stainless Steels

Electrode Size, In.*	Electrode Length, In.	Flat-Position Amperage	Vertical-Overhead Amperage	Open-Circuit Voltage	Arc Voltage
0.0625	9 or 18	25 to 50	25 to 45	30 to 35	20 to 24
0.075	9 or 18	40 to 70	35 to 60	35 to 40	22 to 25
0.0938	9 or 18	50 to 80	45 to 70	40 to 45	23 to 26
0.125	14	70 to 105	60 to 95	40 to 45	23 to 26
0.156	14	94 to 140	80 to 130	40 to 45	23 to 26
0.188	14	125 to 175	110 to 150	45 to 50	24 to 28
0.250	14	150 to 225		45 to 50	24 to 28

*Electrode size should usually equal the thickness of sheet. Allow ¼ in. maximum for flat work and 5/32 in. maximum for vertical or overhead work.

Table IV. Butt Joint Design in Terms of Plate Thickness

	Up to 3/16 in.	3/16 to 7/16 in.	½ to ¾ in.		Over ¾ in.	
	Square	Single-vee	Single-vee	Single-U*	Double-vee	Double-U*
Included angle	0	60° to 70°	60° to 70°	30°	60°	30°
Root face	equal to thickness	1/16 to 3/32 in.	3/32 in.	⅛ in.	⅛ in.	⅛ in.
Root opening	one-half thickness	1/16 to ⅛ in.	⅛ in.	0	⅛ to 3/16 in.	0
No. passes	1	Multiple	Multiple	Multiple	Multiple	Multiple

*U-joints with 3/16-in. radius preferred for thicker sections because less cutting and less weld metal are required.

ed. Table IV gives the butt-weld joint designs that are recommended for different plate thicknesses.[6]

The square butt joint is used for sheets and plate up to 3/16 in. thick. At the lower end, it can be employed in thicknesses of stainless down to about No. 20 gage. In the welding of very thin stainless, there is a danger of piercing through, avoided by the use of the lap or edge joint.

The single-vee butt joint is employed with plate thicknesses considerably greater than that encountered in the square butt joint. Plate thickness from No. 10 gage upward should employ the vee butt joint. The U-joint, double-vee and double-U joints are also employed in the heavier thicknesses.

In selecting a joint design, remember that it is important to obtain full penetration of the filler metal and thorough fusion of the side walls. In the welding of heavy-gage plate, multiple-pass welding is usually necessary, and movement of the electrode is easier on a double-vee or double-U joint because you can work from both sides.

In a multipass welding procedure, peen the previous bead before overlaying the next bead.

Fillet weld joints correspond to the square, single-vee and double-vee butt joints. The square tee joint, which corresponds to the square butt joint, is used for ordinary plate thicknesses, principally for loads which place the welds in longitudinal shear. Welding is performed on each side of the upright, giving a double fillet.

The single-bevel tee joint, which corresponds to the single-vee butt joint, is suitable for much more severe loads than the square tee because of its better distribution of stress. It is employed in heavier gages, and the weld is placed on only one side of the joint. Usually, multipass welding is necessary.

The double-bevel tee joint, corresponding to the double-vee butt joint, is suitable for heavy loads in longitudinal or transverse shear; the welding is performed on both sides of the joint, using a multipass welding procedure.

For thin materials, the lap joint is formed either as a single or double fillet lap, the latter being more able to withstand severe loadings than experienced with the single lap joint. The edge joint is formed by flanging sheet edges and fusing them together; this type of joint is unsuited for severe impact or fatigue loading.

Preheat and Postheat

As previously mentioned, a preheat on the martensitic stainless steels, if followed by immediate welding, serves to reduce internal stresses and minimize cracking. Postheating in the form of an anneal is also practiced; both the temperature and the rate of cooling from the annealing temperature are of extreme importance in obtaining a ductile weld. A cooling rate of not more than 50 deg F per hour is recommended until temperature reaches 1,200 F, after which the cooling may be more rapid. However, it is not recommended that the work be removed from the furnace until it has reached a temperature of approximately 600 F.

Due to the danger of cracks developing at the root of the weld in straight-chromium steels, single-vee joints welded from one side should be used only when absolutely necessary[6] and then with back-up strips. A poorly fitting back-up strip or ring, or a wide space between members at the root of a fillet weld is frequently to blame for cracks originating in the first bead of the weld metal. Some loss in chromium and other elements may occur in transferring through the arc; this should be allowed for in the analysis of the core wire and coating. High-quality welds can be produced in all positions; but porosity is difficult to eliminate completely in any but the downhand position.

In some instances, it may be impractical or uneconomical to provide an anneal. Then an austenitic electrode is employed, either 18-8, 25-12 or 25-20 stainless, the latter two being preferred. We have already mentioned the danger of failure if such a weld is repeatedly heated and cooled, owing to the wide difference in the coefficient of expansion between the austenitic weld and the straight-chromium base metal. If the corrosion resistance of the weld deposit is to be at a maximum, a stabilized columbium-bearing rod is recommended; this is especially necessary where the welded item is to be annealed after welding to prevent the formation of carbides.

As we have earlier shown, fusion welding of the ferritic stainless steels will result in grain growth in the zone adjacent to the weld. This detracts from the ductility of the resultant weld. However, the ductility may be improved to some extent by an anneal at 1,450-1,500 F, followed by a slow cool. The restoration of ductility to the welded joint is obtained by carbide spheroidization[12] rather than by recrystallization of the grains. Because of the high electrical resistivity and low heat conductivity of type 430 stainless, the welding current should be approximately 10% lower[12] than that employed for the same size of mild-steel electrodes. Excessive puddling is not recommended, and the amount of welding should be held to a minimum so as to minimize grain growth. Ferritic steels can also be welded with an austenitic rod, either stabilized or unstabilized, depending upon whether the weld will be subsequently annealed and whether or not it is to have maximum corrosion resistance.

Automatic Arc Welding

SUBMERGED-ARC automatic welding is used principally in either straightline or circular welds on work which is of a repetitive character. In this type of welding, the arc length is controlled entirely by the weldor and its uniformity is practically dependent upon the weldor's skill and constant care. The wire feed is automatically controlled so as to maintain uniform welding voltage. Melting of the end of the electrode takes place well under the layer of granulated flux material, and no arcing is visible. As with mild-steel welding, the submerged-arc process makes it possible to employ much higher currents, which means that larger-diameter electrode wire can be used. From this, it follows that deep grooves in heavy plates may be filled in one pass.

In the automatic welding of a $\frac{3}{4}$-in. columbium-stabilized plate having a 45-deg joint angle, a welding speed of 12.5 ipm was realized at a current of 900 amperes at 40 volts. Tensile tests of the joint showed a tensile strength of 76,450 psi and a yield strength of 40,000 psi. Corrosion tests indicated that the weld was as corrosion resistant as the base metal.

Inert-Arc Welding

INERT-ARC welding, utilizing helium as the protective medium, is used to some extent at Landers, Frary & Clark for the welding of relatively light-gage stainless steel. Present practices usually limit this method of welding to materials less than $\frac{1}{2}$ in. thick. Direct current, straight polarity is employed. The non-consumable tungsten electrode is capable of carrying high current densities.

Because the welding heat is confined to a small area, welding speed is faster, the heat-affected zone smaller and distortion low. The absence of flux affords closer control, improved weld quality, better visibility of the weld pool and no entrapment of slag.

TYPE 430 being inert-arc welded at Century Equipment Co., Chicago. This straight-chrome alloy is a satisfactory substitute for restricted nickel-bearing stainless steels

WITH OR WITHOUT FILLER

Filler rod, if used, can be added at will. On light-gage material and with the proper joint design, inert-arc welding can often be done very satisfactorily without the use of filler rod. With an edge joint, for instance, the melting of the flange edge provides the weld metal. The weld often appears smoother than a joint where filler rod was employed, and finishing costs are less.

Where possible, fixtures should be employed to hold the components to be welded in line; in many instances, tack welding may be used to good advantage to hold the alignment prior to actual welding. The air-cooled electrode holder is satisfactory up to 90 amp and is suitable for welding thicknesses up to $\frac{1}{16}$ in. unless particularly high welding speeds and consequently high welding currents are involved. The water-cooled electrode holder is used where current capacities up to 300 amp are required.

The extent of intergranular carbides within the weld area will be dependent upon such factors as: (1) the section size welded, (2) the position of welding, (3) the joint design and length of time needed to produce the completed joint and (4) the experience of the operator. As with other methods of welding, the stabilized grade of stainless is employed where complete freedom of intergranular carbides is demanded. The downhand welding position is preferred since it will permit both greater welding speeds and less experienced operators. If other welding positions are employed, operator skill must be greater and production will be less.

Machine welding can be used in the welding of light-gage materials and may effect an improved weld as well as cost savings. However, machine welding should be thoroughly investigated for each specific application since this method is of greater advantage where repetitive welding is to be performed. Precision jigging and alignment are prerequisites.

Of interest is the work of Herbst and Pilia,[11] who reported on test work on the physical properties of an inert-arc weld in type 302 composition. They indicate that the weld joint may be expected to have 90 to 95% of ultimate tensile strength of the base metal. Elongation from 48 to 60% in the 2-in. gage length on bend specimens have been obtained. Analysis of the weld metal indicates no increase in carbon and, more importantly, no loss of chromium or nickel. The investigators concluded that the retention of alloys ordinarily lost is because of the excellent protection of the weld puddle from the atmosphere by the inert gas.

Good joint design is a prerequisite to inert-arc welding; butt joints up to $\frac{3}{8}$ in. are made without filler rod[4] by

using a pass on each side. A one-sided single-pass weld[4] can be made with full penetration on ¼-in. material, using a ¼-in. electrode and from 300 to 400 amp, d-c, straight polarity. In the opposite direction, material as thin as 0.010 in. can be welded, utilizing argon as the protective atmosphere with either a-c or d-c straight polarity.

In welding the straight-chromium stainless, the overall heat can be reduced[4] by the use of a longer arc; this spreads the heat over a larger area and appreciably reduces the temperature differential between the weld and the parent metal.

Gas Welding

OXYACETYLENE welding is used with success in the joining of the austenitic stainless steels. Gas welding is usually confined to material of 18 gage or lighter. Success in welding can only be realized by the use of good joint design and a thorough cleaning of the joint area prior to actual welding.

In this method of welding, the speed of travel is wholly dependent upon the operator, who sets his pace in accordance to the specific welding application. Due to the comparatively slow speeds, cooling rates within the weld area will be slow, permitting greater distortion and a more pronounced segregation of intergranular carbides within the heat-affected zone. The former effect can be minimized by the use of fixtures, while the latter effect is either eliminated by the use of stabilized compositions, or minimized by the use of cooling devices such as chill bars.

It is necessary to maintain a neutral flame. A reducing flame may result in the absorption of carbon and thus adversely affect the corrosion resistance, while an oxidizing flame is equally harmful in that it can cause porous welds.

Table V. Recommended Rod Sizes for Oxyacetylene Welding

Thickness of Metal	Rod Diameter, In.
18 gage and lighter	1/16
18 to 16 gage	1/16 to 3/32
16 to 10 gage	3/32 to ⅛
10 gage to 3/16 in.	⅛ to 5/32
¼ in. and heavier	3/16 to ¼

The stainless filler rod used in oxyacetylene welding has no protective flux coating. Full dependence for protection is placed on the neutral flame and upon the use of a separately applied flux. This is not as positive a protection as that obtained in metal-arc welding. Experience indicates that the employment of tips one or two sizes smaller than the tips used for similar gages of carbon steel is good practice[3]. Recommended filler rod sizes for different thicknesses are given in Table V[1]. The angle of welding should be about 80 degrees to the surface of the sheet, and the inner cone tip should not be less than 1/16 in. from the surface of the molten puddle.

Single-pass welding is recommended. If it is necessary to rework a pass, the partially welded joint should be preheated for a reasonable distance ahead of the actual point of welding, the preheat temperature being at a maximum of 500 F. This will tend to minimize warpage and stress concentrations.

Atomic-Hydrogen Welding

THE ATOMIC-HYDROGEN method of welding is similar to the inert-arc process in that a protective gas is employed. The protective gas is hydrogen, and the additional heat obtained results in a much higher temperature of welding than in metal-arc welding procedure. This fact suggests a need for both cooling devices and welding jigs, particularly jigs that will preserve the alignment and combat warpage.

The atomic-hydrogen method is used to a considerable extent on light-gage stainless sheets where emphasis is placed on speed of welding. The speed is critical: too slow a speed may result in burning through, and too fast a speed may cause severe shrinkage of the weld and lead ultimately to failure.

Of interest is the method of determining the gap distance between the two tungsten electrodes.[5] When the electrodes are held together closely, a "silent" arc is obtained, which permits good control in the welding of thin-gage material. The "singing" arc, which is developed by extending the gap between the electrodes to a greater extent, will cause cracks and "wormholes," the latter being discontinuities within the center of the weld and running lengthwise.

This method of welding is used to join both the chromium-nickel and the straight-chromium stainless steels. Joint designs may be butt, lap, fillet and raised edge—very similar to the joints employed in metal-arc welding. There may be a few instances where additional protection of the weldment from hydrogen is needed; in this event, a flux can be employed. The process lends itself very well to automatic operations on light-gage work involving straightline or circular welding; in straightline welding, speeds at a rate of 28 ipm[5] have been reported.

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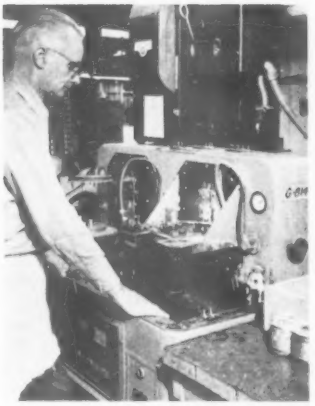
Brazing of Stainless Steels

Whether the material is austenitic stainless or straight-chromium steel, on some occasions the best production process is silver brazing. Here's how you do it.

A Welding Engineer Staff Report



INDUCTION silver brazing adds drain connections to jet engines at Solar Aircraft, Des Moines, Ia.

TORCH brazing at Harrison Steel Cabinet Co., Chicago, reinforces corners of kitchen cabinet doors

USUALLY stainless steels are brazed with silver-brazing alloy, though the "superalloys" working under extreme temperatures are generally "Nicrobrazed." The superalloys, however, are beyond the scope of this article.

Most austenitic stainless steels (302, 304, 321 and 347—all the 18-8 varieties) are readily silver brazed. The exception is the machinable 303, which is somewhat difficult to braze. Likewise the straight-chromium types, such as 410, 416, 430 and 446, are difficult to braze. As a general rule, the higher the chromium content of a stainless the more difficulty in brazing.

Clean Thoroughly

Cleaning is most important for successful brazing and must be thorough. Even on the straight-chromium steels, the brazing is easy if the cleaning job is adequate. Degreasing is not enough; the joint area should be further cleaned by wire brushing or by grinding with power-driven tools to remove all of the chromium oxide film from the joint area. When this has been done, apply brazing flux liberally to prevent further oxide formation. Care should be exercised to see that the flux is applied evenly and that there are no bare unprotected areas.

Heating for the brazing should begin as soon as the flux has dried. Any heating method—oxyacetylene, induction, resistance or furnace—may be used as long as both parts are heated evenly. If this is done, the joint areas of both parts will be ready for brazing at the same time, eliminating the possibility of oxide formation and an incomplete braze.

Parts of different thickness are sometimes difficult to bring up to temperature together. Unless this is done, however, the flux on the hotter piece may become highly oxidized, resulting in a poor braze.

Prolonged heating will tend to cause carbide precipitation unless the material is an ELC or titanium-stabilized stainless.

Space Joints Properly

Another point to be remembered in the heating of the stainless steels: they have different coefficients of expansion. Austenitic stainless, for instance, expands about 40% more than ferritic stainless or than carbon steel. Such wide differences in expansion may mean difficulties in brazing, particularly when dissimilar materials are to be brazed. The remedy is to vary the joint spacing to compensate for the differences in expansion. If this is done, the difficulty disappears.

Under normal circumstances, the joint should be designed to provide good fit-up with clearance of 0.0015 to 0.005 in. between the surfaces to be brazed.

Jigging is important. It is essential that the work be supported so the assembly will be held in proper alignment during the brazing operation. Some assemblies require little support, but even so the members should be held firmly together so that no strain will come on the joint until it has cooled below the melting point of the brazing alloy.

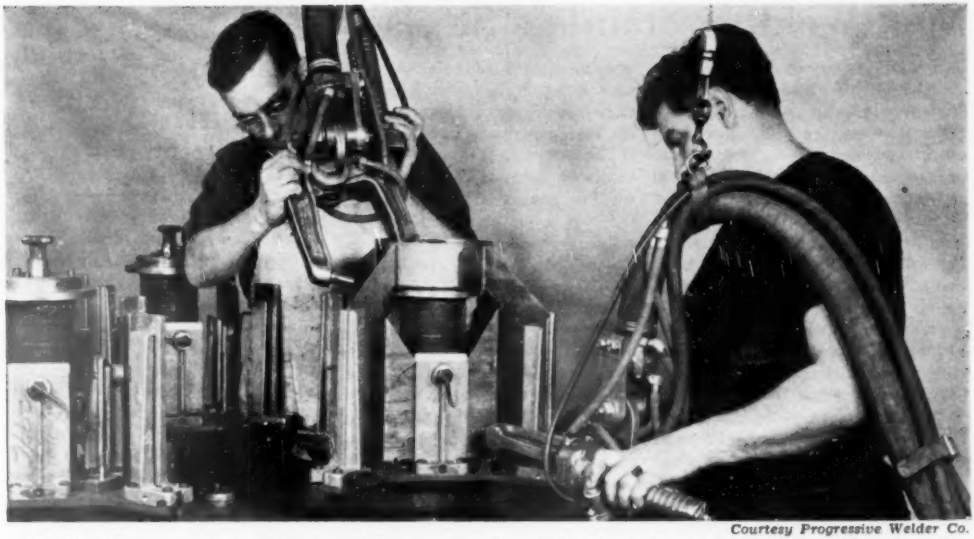
The jigs should be designed to provide support with a minimum of interference to the weldor. He will be able to do a better job if he is free to devote his entire attention to brazing without having to dodge jig framing.

Postbraze Cleaning

Not the least in importance is the final cleaning after brazing. This job should be a simple one if sufficient flux has been used and if the stainless steel was not overheated. Under these conditions, the flux is generally removed by hot water or steam. Unless the excess flux is removed after brazing, the part will be subjected to corrosion. This is likely to cause a bond failure, making it possible to peel the brazing alloy off the steel.

Even the most intricate assemblies, made of the difficult-to-braze stainless alloys, may be joined successfully by silver alloys if care is taken. Cleaning is most essential—all surfaces to be brazed must be cleaned to the pure metal. After cleaning, degreasing is a must to remove any traces of oil or grease, even so slight as finger marks.

Careful preparatory steps will pay off when brazing stainless.



Courtesy Progressive Welder Co.

PORTABLE guns are used where the welding tool must be taken to the work instead of bringing work to the tool

Resistance Welding of Stainless Steels

Lower currents and higher pressures than for mild steel is the general rule for austenitic stainless. Research remains to be done on straight-chromium steels.

BY LESTER F. SPENCER
Chief Metallurgist,
Landers, Frary and Clark

UNDER resistance welding is included spot, pulsation, projection, seam and flash (or butt) welding. All these processes depend upon the resistivity of the material to be joined to the passage of an electric current.

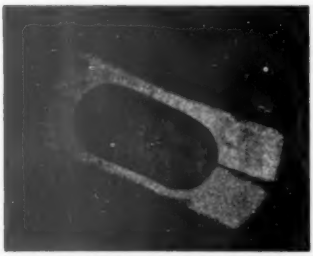
In order to produce a satisfactory weld, it is necessary to control the following factors: (1) the amount of current passing through the work; (2) the time at which this current is allowed to flow and (3) the electrode pressure on the work. Welding speed is directly proportional to the rate of heat generated, which in turn is dependent upon the physical properties of the material to be joined. The mathematical expression commonly used for resistance-welding procedure can be stated as:

$$\text{Heat} = I^2RT(K)$$

where I is the current in amperes.
R is the resistance of the work in ohms.
T is the time of current flow in seconds.
K represents radiation and conduction losses experienced in both the material welded and the electrodes employed.

Regardless of the method employed for resistance welding, the surfaces of the area to be joined should be completely free of scale, oxide, dirt, grease, drawing compound, etc. This is especially true with the austenitic stainless alloys since carbonaceous material on the surface of the areas to be welded may form harmful carbides.

Due to its metallurgical characteristics, the 18-8 (type 302) stainless steel is actually easier to resistance weld[s] than most carbon steels; care, however, must be taken to maintain all critical welding variables at reasonably correct values. The welding currents employed are lower than those used on plain carbon steels due to the higher electrical resistivity of the stainless alloys. The pressures maintained during the welding of the austenitic stainless steels are considerably higher than those for mild steel because of the higher tensile strengths of the stainless materials.



1—SATISFACTORY weld nugget in type 302 stainless steel (25X)

2—HIGHER magnification (250X) of the spot weld shown in Fig. 1

Spot Welding Stainless Steels

THE WELD TIME employed in the spot welding of the austenitic stainless steels should be at a minimum so that the heat of welding will not produce objectionable carbides within a heat-affected zone. The temperature of a resistance weld may reach a maximum of 2,700 F. The area adjacent to this weld nugget is at a lower temperature but still above the carbide precipitation zone, 800 to 1,500 F. There may even be a third zone, where conditions are favorable to carbide precipitation, both because of high temperature and because of the time taken to cool to room temperatures.

The development of this third carbide zone in thin-gage material may be eliminated by reducing the welding time and permitting the material to cool rapidly. Rapid cooling is achieved by running water on the weld area directly after the weld has been completed.

Heavier gages of stainless, ⅛ in. or more, may have scattered carbides within the heat-affected zone, the importance of which is directly dependent upon the corrosive influences the weld joint will experience. Where the time factor can be held to a minimum, a series of sharply peaked curves will result for temperature zones in both the heating and cooling phases. To achieve this, it is often desirable to use synchronous precision timing equipment, especially in the welding of thin-gage stainless sheet.

Where service conditions fall within the carbide precipitation range, 800-1,500 F, it may be mandatory to use the stabilized grades of stainless, types 321 and 347, to prevent the precipitation of harmful carbides. The addition of these stabilizing elements[8] results in increased current requirements and produces welds of somewhat lower strength. It is also necessary to employ a somewhat lower electrode force with stabilized alloys.

Spot welding and its modification, projection welding, utilize electrodes of a small face diameter to concentrate both the current and the pressure on a limited area of flat or semiflat surface. A spot-welding procedure consists of four definite phases: (1) the squeeze time, the period between pressure application and weld; (2) the weld or heat time (usually given in cycles); (3) the hold time, the period that the pressure is maintained after the weld is made and (4) the off time, in which the electrodes separate to permit the material to be moved to the next spot.

The American Welding Society has tabulated electrode force, weld time, welding current and other variables for spot welds in various gages of stainless steel. It is recommended[9] that not less than five cycles of time be employed in a spot-welding procedure unless a control of ¼ of a cycle can be maintained. With stainless, the pressure is two or three times that employed for mild steel, but the current is usually from 10 to 15% less. Such factors as current, time and electrode tip pressure should be predetermined for each specific case and then strictly followed in repetitive production.

While the recommendations of the AWS resistance welding committee can be used as a starting point, it may be necessary to conduct individual experiments. Specimen weld nuggets should be sectioned, etched and polished to determine whether or not a satisfactory penetration has been obtained. Figures 1 and 2 are photomicrographs of a satisfactory weld nugget in type 302 stainless; notice that there is no severe indentation in evidence and that a good portion of the weld consists of the characteristic columnar structure. The slight shrinkage cavity in evidence within the weld nugget has very little effect on the weld strength. The material welded was 0.028 in. thick.

The basic types of spot welders are: (1) rocker arm; (2) press type; (3) portable and (4) multiple-electrode. They have various methods of operation and cover a wide range in both size and capacity.

The rocker arm welder, as its name implies, has an upper electrode that can be raised to load or unload work; this type is usually preferred in the welding of light gages. The press welder is so called because of the straightline operation of the upper electrode. The portable type, variations of which are many, is used for welding massive structures where it is better to move the equipment to the work. Portable welders include pinch guns, expansion guns and bar-operated or lever-operated guns. Multiple spot welders are usually designed for specific jobs; the welds are made in multiple, either vertically or horizontally depending upon the application.

Pulsation Welding

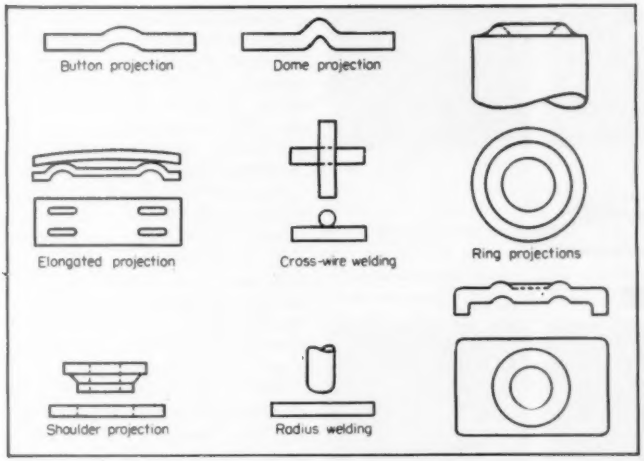
IN PULSATION welding, the current is interrupted one or more times without either removing the work or releasing the pressure. It is employed for the spot welding of material ¼ in. and thicker.

The advantages of pulsation welding for heavy gages are: (1) water cooling in the off-time cycles permits better electrode life; (2) thicknesses can be welded that would be difficult to weld by other methods; (3) equipment capacity is usually increased by this type of welding; (4) weld consistency improves in some cases; (5) the use of lower current values minimizes spitting and splashing of the weld metal along with lower kva demand and (6) scaly steels and oxide coatings can be penetrated (considered bad practice in the welding of the austenitic stainless steels). Brittle compositions such as the straight-chromium compositions can often be alternately welded and annealed by pulsation welding.

A flat-type electrode is employed as in single-impulse spot welding. Both the electrode force and the number of impulses will depend upon the thickness of the material to be welded. The values as tabulated by the American Welding Society can be used for guidance.

Projection Welding

PROJECTION welding is also a form of spot welding. The current flow and the heat generated during welding are localized at predetermined points by the use of projections or embossments on one or both of the metal sections to be joined. Various types of projections are illustrated in Fig. 3. The dome projection is preferred for welding material less than 0.031 in. thick; the button projection is usually employed for flat stampings that are over 0.031 in. thick. The elongated projection is best suited for insuring proper contact in curved sections. The cross



3—SOME common projections. The dome projection is preferred for material under 0.031 in.; the button type for flat stampings over 0.031 in.

wire projection is used to a considerable extent in the welding of wire products, and the shoulder projection is employed in plug welding. The ring projection is used to great advantage in screw machine products and can also be employed for stampings.

In projection welding, there is an optimum height and diameter of projection on each thickness of material. If the projection height is greater than the optimum, the metal at the edge of the projection is weakened and an inferior joint will result. If the projection diameter is above that recommended, the current will be proportionately increased and may cause difficulty in obtaining a uniform current distribution within the weld area; this ultimately affects the weld strength. Again, the recommendations as given by AWS can be used as a guide.

Projection welding is usually performed in multiple; this simultaneous welding makes it mandatory that the projection height be uniform and in the same plane. So many variables are encountered—the material to be welded, stock thickness, size and number of projections and throat area, etc.—that it is difficult to estimate the time, current and pressures required. Also, the load and stress concentrations within a specific design must be considered. Whatever the load is, the number and spacing of projections must be adequate. Spacing of projections is of considerable importance since too close spacing may result in current shunting and weakened welds. Shunting also decreases the life of projection-welding dies.

Pressure and follow-up are quite important in projection welding procedures. Frictionless head movements are necessary because of the relatively small contact area at the start of the current flow. Inversely, the small contact area means high current densities before the metal becomes fused. Projection-welding electrodes are usually dies that have been form fitted to the projection design.

Seam and Roll-Spot Welding

IN SEAM WELDING, the weld is made lineally between two contact rollers or between one contact roller and a contact bar. This method of joining is ideally suited to the production of gastight welds in the austenitic stainless steels. A seam weld can be considered as a series of overlapping spots, the overlapping being controlled by both the timing and the speed of the rollers. When spots do not overlap sufficiently to produce a gastight joint, the process is often referred to as roll-spot welding. In either roll-spot or seam welding proper, the welds are made at much higher speed than is usually possible with standard spot-welding equipment; however, there is a great similarity in the principles of good design practice for both processes.

The use of synchronous interrupted timing is preferred for most seam welding applications since it controls the heat effect and allows each "spot" to cool under pressure during the off time. Synchronous timing permits less distortion and warpage and retards the tendency of the heat to build up ahead of the welding wheels. It also gives better control over surface disturbances.

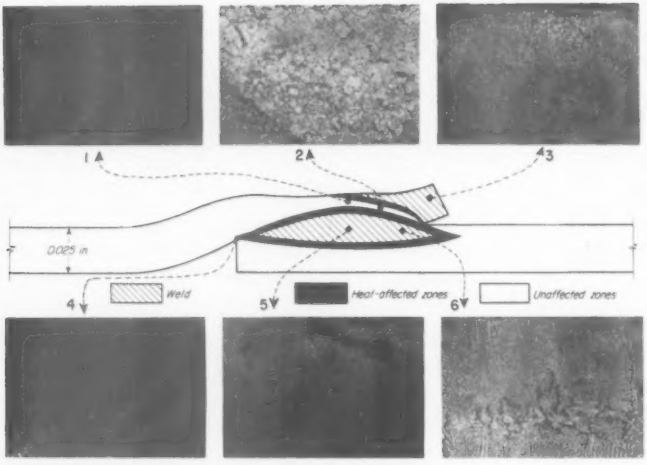
As with spot welding, close supervision is required in order to maintain weld quality in the seam welding of the stainless steels. The pressures utilized should be approximately 75% greater[9] than those employed for mild steel, and the current approximately 50% less. Welding speeds are much slower. The "on-time" should be as short as possible so as to prevent intergranular carbides within the austenitic grades. Basic informational data as compiled by the AWS may be used as a guide in the selection of values for electrode force, on-time, off-time, welding speed and welding current.

In the seam welding of type 302 stainless, 0.025 in. thick, intermittent or stitch welds may be produced with the following conditions[6]:

Speed: 105 ipm.
Force: 1,275 lb.
Current: 3,700 amp.
Timing: 4 cycles on, 4 cycles off.

The seam welding of type 430 stainless, a ferritic alloy without nickel, has been done successfully on an experimental basis at Landers, Frary & Clark. The quality of the weld increases as both the amperage and pressure are increased above the values used for the austenitic stainless steels. Metallographic examination of a specimen joint indicated good fusion; this was supported by the tensile values obtained from sections containing the welded joint. The thickness of the material tested was 0.033 in.

The welding of type 430 stainless was not satisfactory under the conditions employed for type 302 stainless. Metallographic examination indicated incomplete fusion as well as voids in the weld proper. Tensile values were erratic and in every case the break occurred at the weld. With increased force and amperage, the work



4—SEAM-WELDING joint shows microscopic grain structures of various weld and heat-affected zones. Defects are revealed at positions 5 and 6

done on type 430 stainless looks very promising. A comparison of tensile strengths obtained with the two procedures is given in Table I.

In seam welding the austenitic stainless steels, the wheel width is a controlling factor in the production of acceptable welds. As the material increases in thickness, there should be a corresponding increase in the wheel width. The wheels employed should have at least a 75% conductivity and a hardness of 76 Rockwell B. Do not use identical wheels on both sides of the work in the seam welding of unequal thicknesses of stock[6]. Since a greater proportion of the weld nugget will be within the thicker section, the proportion of weld nugget in the thicker section must increase as the gage of the two materials welded increases. In one example, the wheel used against the thinner sheet was of RWMA Class 3 material[8] with a ¼-in. face and a contour radius of 1½ in. Against the thicker sheet, was used a wheel of RWMA Class 1 material with a ⅜-in. face and a 3-in. radius. Welds with a 50% penetration in the thinner sheet were obtained.

The design of the assemblies should be carefully checked[4] for work clearances since there is a definite economic advantage in the use of standard arms and wheels. In some instances, where the joint design is more complicated than the standard lap joint, special wheels and fixtures must be designed for seam welding.

Seam Weld under Microscope

The use of a properly prepared and etched cross-section is invaluable in determining the quality of a seam weld. The survey obtained on one seam weld in type 302 stainless is illustrated in Fig. 4. The specific areas indicated by the numbers on the sketch were photographed under a magnification of 375X to show the structure at six positions.

Position 1 represents a portion of the unaffected and the small heat-affected zone on the outer portion of the weld. In general, the weld zone is rather broad, approximately 0.085 in. long and 0.0170 in. wide, while the heat-affected zone is comparatively small. The unaffected metal within the area shown in position 1 is satisfactory.

In position 2, the structure of the weld and heat-affected zone is satisfactory. Position 3, a mixture of the heat-affected zone and actual weld structure, shows the small "tit" affected by the welding. Position 4 shows the heat-affected zone on the edge of the weld and a portion of the unaffected metal.

This weld was satisfactory in that no carbide precipitation was in evidence. It was not, however, a perfect weld. A cavity in the center of the weld was found in position 5, and position 6 reveals an intergranular condition. Neither of these defects affected the quality of the weld, as determined by hydrostatic test.

Seam welds that are classed as unsatisfactory under the water test usually have incomplete fusion zones, caused by either an insufficient welding force or by too low an amperage. The photomicrograph of one poor seam weld revealed both a definite separation and the absence of a weld nugget.

In the welding of the austenitic stainless steels, heat shrinkage and distortion is often experienced; this is due to the higher rate of heat generation as compared to that experienced in the seam welding of mild steel. An important factor in maintaining distortion to a minimum is the circulation of external water to cool the weld area rapidly after the weld is made. Water cooling will materially lengthen electrode life and minimize the tendency toward mushrooming. Where several rows of seam welds[8] are required within a product, a sequence of welding and peening may be necessary.

Some materials are sensitive to water cooling, which may cause difficulties in the seam welding of dissimilar metals. An example is a job where a carbon-steel insert was to be welded

Table I. Tensile Strengths of Seam Welds in Type 430 Stainless

Welding Procedure as Employed for Type 302 Stainless	Comments	Welding Procedure with Increased Pressure and Amperage	Comments
60,000 psi	Crack at weld	69,090 psi	Break at weld
17,000 psi	Break at weld	68,000 psi	Break on strip
42,727 psi	Break at weld	68,000 psi	Break on strip
33,939 psi	Break on weld	75,757 psi	Break on strip
35,151 psi	Break at weld	72,121 psi	Break on strip
21,212 psi	Break at weld	75,151 psi	Break on strip
		68,000 psi	Break on strip
		71,515 psi	Break on strip
		69,090 psi	Break on strip

Note: Lap joint—5/16 inches overlap.

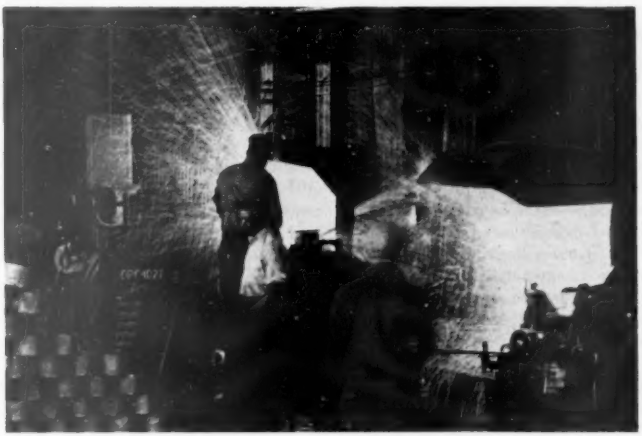
onto an austenitic stainless part. A crack resulted within the insert upon circular welding; this was due to the high hardenability displayed by the carbon-steel component. The direction of water flow was changed so that the carbon-steel insert would not be exposed to the water. This still was not entirely satisfactory because of wheel wear. Finally, it was necessary to obtain a carbon steel that had a low hardenability and so was not sensitive to water cooling.

Seam welders are classified as (1) longitudinal; (2) circumferential or circular; (3) combination, longitudinal and circular.

In the longitudinal steam welder, welding is done along a straight line. The work is fed into the machine throat, which will ordinarily vary in length up to 60 in.; seam welds as long as 90 in., however, have been made on this type of equipment. The weld is started at the extreme edges of the work by a synchronous timer and motor starter.

In the circular seam welder, the head welds a cylindrical section at right-angles to the longitudinal seam. The work either goes into the machine throat or projects away from the welding wheels. As an example, one circular seam welder has a 24-in. throat, an electrode force of 3,000 lb and the capacity to weld stainless sections up to 0.109 in. thick.

The combination or universal type of seam welder permits the welding head to be swiveled 90 deg. Hence either longitudinal or circular welds can be made on the same machine.



Flash Welding for Butt Joints

FLASH welding is a butt-welding process in which the heat between the two workpieces is generated by an intense flashing arc. After the metal in the arc has been brought to the fusion point, pressure is introduced to bring the two pieces together and forge them into one.

Flash welding is usually done in a horizontal position, but vertical flash welding is possible. This method of resistance welding depends particularly on the degree of alignment to obtain a quality weld; this is especially true in the flash welding of relatively light materials such as thin-wall tubing.

In the flash welding of the austenitic stainless steels, approximately 15% less heat is required than with mild steel and faster welding speeds are possible. Tensile properties of flash-welded joints are almost identical[6] to that exhibited by the annealed material. Table II gives values obtained and some welding conditions for ½-in. diameter rod stock of type 302 stainless[6].

Flash welding is used to a considerable extent in joining the straight-chromium compositions having from 3 to 10% chromium. To a lesser extent, it has been used for welding tubing having from 10 to 16% chromium. Standard flash-welding techniques are employed. To permit the removal of the flash from inside the weld, softening by heat treatment is required of the air-hardening compositions.

Ferritic stainless steels can also be flash welded; however, a loss in ductility may be experienced in the heat-affected zone because of grain growth. Of interest is the introduction of inert or non-oxidizing atmospheres[5] to protect the weld during the flashing period; this has been found effective in reducing the formation of a chromium oxide and improving the mechanical properties of the weld.

Table II. Test Results for Flash Welds in Type 302 Rod Stock

Primary Current, Amperes	Kva	Elastic Limit, psi	Tensile Strength, psi	Elongation in two inches, %
100	22.0	35,350	94,600	58.5
110	24.2	36,000	97,200	58.5
120	26.4	35,850	95,600	63.5

Bars were ½ in. in diameter and finished turned after welding.
Fractures occurred ½ to ⅝ in. from the weld.
Welding conditions were: 23 cycles, 6.0 volts secondary, 220 volts primary.

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Cleaning Stainless—

Normal good housekeeping procedures can eliminate preweld cleaning on many stainless steels. Post-weld cleaning is a must, however. Here's how it's done.

A Welding Engineer Staff Report

THE primary factor in securing clean stainless steel for welding is good housekeeping. Steels that are clean when shipped from the mills and are stored and handled properly will not require another cleaning before welding.

Though mill practices vary, some stainless steels do not require the use of oils during manufacturing. Plates and sheets are shipped protected by coatings of paste and paper, or sprayed with lacquers or plastics, depending upon the customer's designation. Figure 1 shows the removal of a plastic film from a clean sheet as shipped by the mill.

IF shop personnel is educated in cleanliness and good housekeeping and IF the importance of keeping the metal clean is stressed, there is no need for adding to the costs of fabrication by preweld cleaning of such a protected sheet as that in Fig. 1.

Some stainless steel, however, is oiled after pickling, requiring the use of a degreasing process. Methods of degreasing will be discussed later.

Cleaning by Wire Brush

When there are scale and foreign matter to be removed, it is the usual practice to wire brush the area. Manual or mechanical brushes of stainless steel wires should be used for this purpose. Other types of brushes tend to leave tiny particles embedded in the surface, which will later rust and cause corrosion.

Oil scale, machining compounds, paints, dirt, rust, etc. will produce cracks and porosity. Hence the joint area should be free of all foreign matter prior to welding. Grease and carbonaceous material are especially objectionable. Ferritic stainless steels such as type 430 carburize very readily, resulting in greater hardness and lower corrosion resistance. Keep both weld area and the heat-affected zone free from any form of carbon.

To remove oil from machining or marking paint, use a cloth saturated with carbon tetrachloride or kerosene. For mass production, however, immersion in a chemical solvent or vapor degreasing may be required.

Chemical Cleaning Methods

Figure 2 illustrates a fully automatic installation for the "soak tank" method of cleaning. An ordinary welded steel tank, heated by steam coils, gas or immersion heaters, is satisfactory. The usual temperature to which the solution is heated is around that of boiling water. There are many different types of chemical degreasers on the market, to fit almost any kind of cleaning problem. To cite a specific example, one cleaning compound is used in a concentration of 4 to 8 ounces per gallon at recommended temperatures of 180 to 212 F. The average time in the tank varies from 2 to 20 minutes, depending upon the extent and type of soil or dirt.

The vapor degreasing method is illustrated by Fig. 3. The parts to be cleaned are inserted into a tank that is electrically heated at the bottom. The tank contains perchlorethylene solvent, which is heated to a vaporizing temperature of 250.2 F. A thermostatic control shuts off the current whenever the vapor reaches a certain height in the tank. It is thus impossible for any vapor to escape. The vapor condenses on the cold parts and runs off as a liquid, carrying with it the grease and dirt. The solvent falls down to the sump of the tank, where it is reheated to vapor. The impurities taken into solution are left behind in the sump.

A continuous supply of vapor is produced from the solvent. Another advantage of this process is that the parts, heated by the vapor above the boiling point of water, are wholly dry when taken out of the tank.

Besides chemical cleaning and wire brushing, sandblasting and shotblasting may also be used to prepare the surface of stainless steel. Either air blasting or airless blasting (centrifugal force) may be employed. As an example of the latter process, the West Leechburg plant of the Allegheny Ludlum Steel Corp. has introduced a centrifugal shotblasting unit into its stainless strip pickling line. A cabinet 24 ft 6 in. long contains four wheels, which are 19.5 in. in diameter and revolve at 2,250 rpm. Shot from a hopper is fed to the wheels, which throw it out against the surface to be cleaned. Optimum shot diameter is said to be 0.011 in., and the velocity of the blast is 14,000 fpm. The machine consumes around 30 lb of shot per hour at a shot cost of 20c per lb. All visible scale is removed prior to acid pickling.

Courtesy Lukens Steel Co.

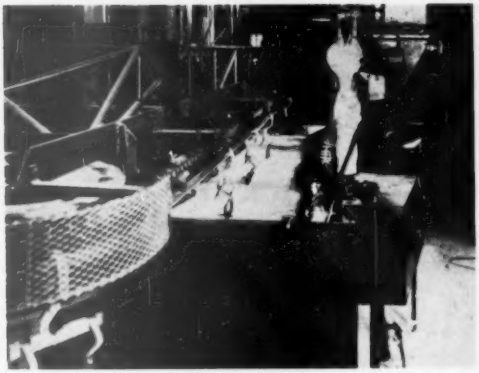
1—PROTECTED by a mill-applied film, this stainless sheet doesn't require cleaning prior to welding

Recleaning Not Needed

If the cleaned stainless sheets are stored in dirt-free surroundings, they need not be recleaned. Good housekeeping can keep the metal from becoming contaminated again before welding. Time has no significance in this connection.

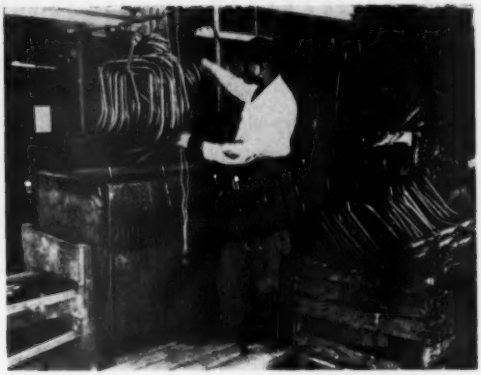
Good storage facilities off the floor and stacking on covered racks are musts for keeping sheet and plate clean. The use of materials-handling devices such as cranes, dollies, hoists, etc. is good practice. Do not drag the work around the shop or factory, and

Before and After Welding



Courtesy Hotpoint Co. and The Diversey Corp.

2—AUTOMATIC installation for tank cleaning. The solvent removes films of oil, grease, etc., producing a chemically clean surface for welding or other work



Courtesy Phillips Mfg. Co.

3—VAPOR degreasing is another good method of chemical cleaning. Vapor condenses on the parts and runs off, carrying away dissolved grease and dirt with it

be careful not to touch it with bare hands since hands leave an oily film. It seems almost needless to caution that one should never walk over stainless sheets and plates or drag them across dirty floors. If plate is dragged across the floor by the edges, foreign matter will be introduced right where the welds are made.

Some welding processes require more thorough cleaning than others as they are more sensitive to foreign matter.

Cleaning for Brazing

Silver brazing, for instance, requires the cleanest surface of all! Areas to be brazed if oily should be degreased by dipping in carbon tetrachloride or similar solution or wiping with a clean saturated cloth. After degreasing, the surfaces to be brazed should be brushed with a stainless-steel wire brush. After brushing, the cleaned joints should not be touched; the oily film from finger marks tends to lift the flux while the heat is being applied. This allows the surface to oxidize, and the silver alloy will not bond or flow.

Spot welding requires very clean surfaces; otherwise arcing, pitting, burning and indentations will result.

Inert-arc welding processes require clean surfaces; otherwise pitting in the weldment will occur.

Metal-arc welding needs (and gets) the least cleaning, but stainless steel should be free of foreign matter before welding.

To clean weld joints takes time and so adds to the cost of the finished product. This fabrication cost can be eliminated or materially reduced by good housekeeping methods.

Postweld Cleaning a Must

Unless the fabricated piece will be in high-temperature service, scale (oxide) formed by welding is likely to cause rust and should be removed immediately. Oil and antispatter compounds used to protect the metal adjacent to the weld must be thoroughly brushed off. Scale due to welding can be removed by weldor's slagging hammer, stainless steel wire brush, grinding or sandblasting.

In regard to sandblasting, there is some controversy. No special technique is necessary to sandblast welds, but the sand should be iron-free and clean. Furthermore, the blast should not be allowed to dwell on any area too long or local erosion and surface irregularities will result.

The scales formed on stainless steel are tenacious and may be impervious to normal pickling, which should follow sandblasting. With this type of scale, care must be used to protect the surface from severe local erosion caused by blasting on sections free of scale.

Pickling or passivation will in most cases insure the removal of all scale and embedded iron. Sandblasting when properly applied leaves a very smooth finish, making the surface easier to polish readily. For information on grinding and polishing methods, see the next article. Solid grinding wheels of suitable grit are used to remove excess weld metal, followed, if necessary, by polishing and buffing to match existing mill finishes.

Cleaning Brazed Joints

Silver-brazed joints must always be cleaned after brazing. This is easily done by dipping the joint area while warm into hot, agitated water. This will normally remove all traces of the flux. If the flux is not removed thoroughly, corrosion or etching of the base metal will develop under the flux.

Whenever the hot water rinse does not remove all traces of flux, dip the parts into a mild acid solution. Many experiments may be necessary to secure the best neutralizer since all fluxes do not react the same when dipped into identical acids.

The chemical cleaning industry has many wetting agents, neutralizers and cleaners that are recommended as flux removers and will not harm the base metal.

Grinding and Finishing Stainless

Grinding and polishing can be costly on welds made in stainless steel. This article tells you how to hold down costs while doing a first-class job of finishing.

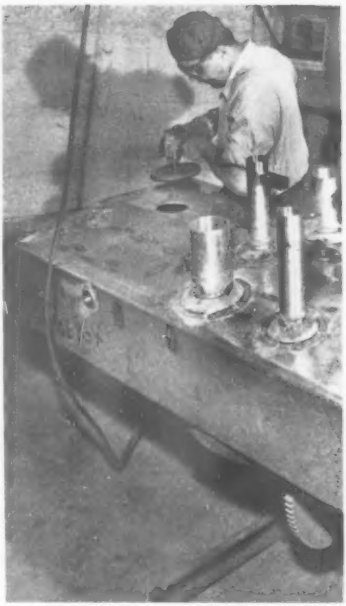
A Welding Engineer Staff Report

STAINLESS steels, particularly the 18-8 types, are widely used in food, dairy and processing equipment. To prevent bacterial growth, all cracks and crevices must be eliminated. Furthermore, exposed surfaces must be highly polished so that they are easy to clean and keep clean. Consequently, the service sides of welds must be ground down and blended with the parent metal.

To avoid the necessity for excessive grinding, keep the weld bead small! The chromium-nickel types of stainless are considerably more difficult to grind than either plain-carbon steels or straight-chromium stainless. Metal deposits on the austenitic types must be carefully controlled, or fabrication costs will mount.

Assuming that the weld bead has been properly kept down, relatively light grinding should prepare the weld on the polished side for final polishing and blending. Even though the weld bead itself may not be exposed, it should be completely cleaned of slag and flux with a coarse-grit grinding wheel to prevent corrosion.

The finishing of welds in stainless steel may be divided into three general operations: (1) rough grinding, (2) polishing and (3) blending and buffing.



POLISHING the underside of base of a stainless-steel bottle filler for

Photo courtesy The Carborundum Co.

ABRASIVE BELT attachment for portable grinder. One operation reduces weld—replacing triple use of cup wheel, sander disc and set-up wheel

Rough Grinding

In the rough grinding operation, excess weld metal is removed by a portable grinding wheel of approximately 24 grit, bonded with rubber or resinoid. The commonly used wheels range in diameter from 4 to 8 in. and are operated at speeds around 9,500 surface feet per minute. The plain grinding wheel is used for curved surfaces and general work, and the flaring cup design for grinding angles and corners as well as flat areas. The cup wheels will minimize gouging or scratching of the flat metal surfaces adjoining the weld.

Slots in channels may be cleaned by using thin rubber-bonded wheels, while mounted wheels and points may be employed to grind otherwise inaccessible areas. In both cases, rigid wheels are used for rough and semi-finish grinding operations and resilient wheels for polishing and blending.

To grind a weld, move the wheel in a continuous motion parallel to the bead rather than across it. Smooth the bead, but do not remove it entirely. A small amount of stock should be left to be removed in pol-

Photo from Cherry-Burrell Corp.

the dairy industry. Highly polished surfaces are easy to keep clean

Seven Tips for Finishing

1. Keep the work as cool as possible. Don't try to shorten finish time by increasing wheel pressure; this will overheat and tint the metal.

2. Always break in a fresh abrasive wheel or belt on scrap material similar to that on which the abrasive will be used. Such broken-in abrasives are essential when making grit comparisons to match a finish.

3. Clean the surface of the metal thoroughly before changing grit size. This is necessary to prevent mixing of grits.

4. Do not attempt to remove too much metal with a fine abrasive. Use the coarsest grit size possible consistent with finish.

5. Remember that fine grit will remove more stock from a surface roughened by coarse grinding than from a smooth surface.

6. Keep abrasive scratches straight and parallel. Herringbone scratches, gouges and chatter marks can be avoided by proper technique.

7. Avoid overpolishing in spots, and lift the wheel from the work before you reverse the direction of the stroke.

ishing; otherwise, a groove will be produced along the weld when the finish is finally blended with that of the parent metal.

Polishing with Finer Grits

Following the rough grinding operation, the weld may be semi-finished before the final buffing with a fiber-bonded wheel in 54 grit. The harder grades are used for the rougher applications and softer grades to produce finer finishes. Set-up polishing wheels employing loose grain are also used in this and subsequent operations. Grit size sequences should be previously determined by experimentation. Two sequences are suggested: 36-60-120 or 54-80-150. The last grit size used should be fine enough to match the finish of the parent metal.

In polishing, strokes always should be made in the same direction as the original polishing lines on the surrounding metal.

Buffing and Blending

Buffing of stainless steels creates highly lustrous and reflective finishes that are not obtainable by polishing procedures. To get these scratch-free, mirrorlike finishes, the surface to be buffed must be free of defects and deep scratches.

Muslin buff sections built up to the required width are used for buffing. These may be the same type as the wheels used with loose grain for the polishing operation. In buffing, however, there is no bonding of abrasive The fine abrasive compound is applied from time to time by holding a stick of cake against the wheel face while it is in motion.

Some of the many factors that will determine the final finish are:

1. Resilience or hardness of the polishing wheel. A specific grit size in a soft wheel will give a different scratch from the same grit size in a hard wheel.

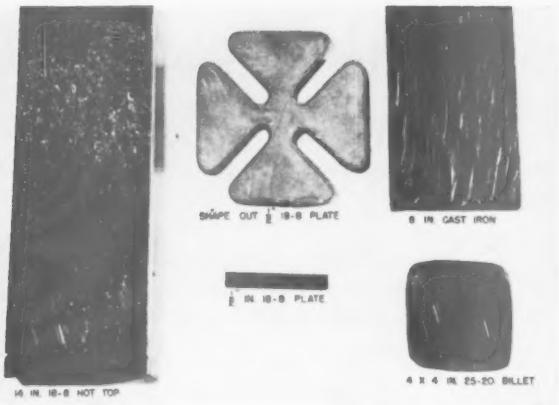
2. Wheel speed. The surface speed at which the abrasive contacts the work influences the cutting action of the abrasive.

3. Condition of abrasive. Fresh and worn abrasive wheels and belts give different results. A used 120 grit abrasive, for example, may produce a finish comparable to a new 150 grit.

4. Type of machine. Portable tools will give results different from those obtained with stationary equipment.

5. The technique of the operator is also of major importance.

The factors which influence finish indicate why it is difficult under shop practice to exactly duplicate a mill finish on a weld bead. To eliminate all evidence of welding, it is necessary to buff the entire assembly with fine-grit abrasives. Many jobs finished this way defy detection of the weld.



1—CUT SURFACES produced by iron-rich powder process in various ferrous materials, including 18-8 and 25-20 stainless steels

Courtesy Linde Air Products Co.

2—IRON-RICH powder cutting of a stainless plate. Note set-up for feeding powder

Better Cutting

Table I. Iron-Rich Powder Cutting

Thickness, in.	Tip Drill Size	Oxygen, psi	Powder, lb/hr	Cutting Speed, ipm
¼	60	50	15	24
½	53	50	18	20
1	53	50	18	15
2	46	50	18	11
4	39	50	18	7
6	31	50	22	5

Table II. Chemical Flux Cutting

Thickness, in.	Tip Drill Size	Oxygen, psi	Powder, lb/hr	Cutting Speed, ipm
¼	54	55	1	11
½	54	75	2¾	9
1	49	55	3¾	9
1½	45	55	4¾	9
2	45	60	5½	8
3	34	75	6¾	6
4	34	85	7	5

A Welding Engineer Staff Report

ALL stainless steels are difficult to oxidize, yet methods have been developed that make it possible to cut these materials readily with both the arc and oxyacetylene flame. All these cutting processes aid oxidation by the introduction of fluxing agents. In arc cutting, the agent is a steel electrode; in the oxyacetylene applications either an iron-rich powder or a chemical fluxing agent is added to the flame.

Odd as it may seem from the above, stainless steels are difficult to cut mostly because of the high affinity of chromium for oxygen at elevated temperatures. When these two elements combine, they immediately form a highly refractory oxide on the surface of the material. This prevents the further oxidization so necessary to cutting. It is strange but true that stainless steels are difficult to oxidize because they oxidize too well in the initial stages.

If these refractory oxides can be eliminated, or at least reduced, the problem of severing stainless steel will be no more. Hence the prime purpose of a fluxing agent is to dilute the surface oxides so as to lower their melting points.

For many years, the ordinary hand cutting torch was used for severing stainless steels. Extremely heavy preheats and oversized tips were necessary, and the torch was moved in a semirotary motion like that sometimes used to cut cast iron. The results were poor all around: poor from the standpoint of finished cutting (very rough); poor from the standpoint of economy and poor from the standpoint of speed.

Other oxyacetylene cutting methods were tried without any conspicuous success until a way was found to introduce powdered material into the oxygen cutting stream to provide a fluxing agent. Then we really struck pay dirt!

Iron-Rich Powder Cutting

In one such method, an iron-rich powder is used. The powder is heated to ignition temperature by the torch preheating flames and burns in the oxygen stream to create a high-temperature reaction. The extreme heat of this reaction makes it possible to

3—SCARFING of an ingot is another application for the powder-cutting process

Courtesy Air Reduction Sales Co.

4—FLUX-INJECTION cutting of rings from 3/16-in. stainless plate. Operator wears a respirator to protect him from the fumes

on Stainless Steels

Table III. Arc-Oxygen Cutting

Thickness, in.	Amp	Oxygen, psi	Speed, ipm
¼	175	3-5	10
½	185	5-10	8
1	200	15-20	6
1½	215	25-30	5¼
2	220	40-45	4½
2½	225	50-55	3¼
3	230	60	2

start cutting without waiting for the usual preheating of the metal.

The apparatus required is relatively simple. Nearly all the extra equipment needed is a powder dispenser—a pressure vessel with a powder ejector built into the bottom. This vessel is operated on compressed air. The air flows through the dispenser, picking up the powder in the ejector and carrying it through a supplemental rubber hose to the torch. The dispenser should be sufficiently large to hold at least an eight-hour supply of powder under a continuous operation. Under maximum operating conditions, the dispenser would have to be of sufficient size to hold 600 lb of powder. Usual practice, however, calls for a 200-lb dispenser.

When cutting stainless steels by this process, use a tip generally one size larger than that required for carbon steels of the same thickness. This larger size tip makes it possible to cut stainless steels at speeds comparable to the cutting of carbon steels. Depending upon the thickness of the metal, the amount of iron-rich powder that will be required varies from ¼ to ¾ lb per minute. Table I gives data on the recommended drill size of the torch tip (cutting orifice), cutting oxygen pressures, powder consumption and cutting speeds.

The iron-rich powder method may be used for all types of cutting and scarfing operations. It is used considerably in the making of production cuts. The characteristic cut surfaces obtained from this process are shown in Fig. 1. It will be noted that the quality of the cut approaches that obtained on carbon steel. Figure 2 shows a close-up of the cutting operation and Fig. 3 the scarfing of an ingot by means of the powder method.

Chemical Flux Cutting

In the other flame-cutting process, a chemical flux is introduced into the oxygen stream. The chemicals are usually sodium carbonate and sodium sesquicarbonate, which together form a suitable flux for reducing the oxides produced during the cutting of stainless steel. The amount of fluxing material required is much less than the amount of iron powder required by the other process, as may be seen from Table II.

Relatively simple equipment is also used in chemical flux cutting (Fig. 4). There is needed only a flux hopper and dispenser unit, equipped with suitable controls for adjusting the rate of flux flow and for properly timing it with the opening and closing of the oxygen valve. The most common flux feeder unit is a portable combination hopper and flux dispenser, which has a capacity of 20 lb of flux or sufficient flux for about three hours' use under maximum operating conditions. There is a vibrator feed device, which has been designed to provide a steady and accurately controlled rate of flux flow into the cutting-oxygen stream. A three-hose torch is used in connection with chemical flux cutting.

There are advantages and disadvantages to both processes, and each has a different field of application. The cuts obtained from either method are good and greatly superior in quality to cuts resulting from the older methods of flame-severing stainless steels.

Arc Cutting

For arc cutting, three processes have been developed, all employing electrodes. In one instance, the elec-

Arc Cutting Processes

Courtesy Arcos Corp.

5—ARC-OXYGEN cutting. Oxygen is fed to the arc through a tubular electrode of mild steel

Eutectic Welding Alloys Corp.

6—METAL-ARC cutting. Coating of electrode is exothermic (heat-liberating) at high temperatures

trode is a tubular rod made of mild steel and coated very much like a normal welding electrode. Oxygen is conveyed through its hollow core to produce an oxygen-enriched atmosphere that will speed the cutting action. By directing the stream of oxygen into the pool of molten metal, the difficult-to-oxidize materials are readily cut.

Even though the electrode is mild steel, there is no contamination of the base metal. The possibility of contamination is eliminated by the combination of extreme high heat and oxygen under pressure. The rod metal and the coating are oxidized (converted to slag) at the point of the arc before the electrode metal can fuse to the base metal.

Though the process is quite simple it requires a special electrode holder (Fig. 5). This is not unlike an arc-welding electrode holder in appearance. It serves the double function of conducting current and feeding oxygen for the cutting. The tubular electrode is inserted and removed from the electrode holder in the same easy manner that an electrode is handled in an ordinary holder.

Cutting begins as soon as the arc has been established, eliminating the need for preheating. The cuts made by this process are fairly true and may be quite smooth, dependent on the operator's skill. Table III gives data on recommended amperage settings and oxygen pressures for cutting the various thicknesses of metal.

In the "Arcair" method, the arc produced by a carbon electrode is fed compressed air so that the metal is literally blown away after it has been melted. A little larger than an ordinary electrode holder, the arc torch includes an air control valve. Air is admitted through openings near the electrode, which is not hollow as is the arc-oxygen electrode.

The third arc method employs a typical metal-arc cutting technique (Fig. 6) but the electrode has a coating that is extremely exothermic (heat-liberating) at high temperatures. Its action is much faster than ordinary metal-arc cutting.

These various methods of cutting stainless steel are looked upon with great favor by fabricators and warehousers of stainless steel. Not all of them, however, are favored by the same fabricator. While one may prefer an oxyacetylene method, another finds that an arc process of cutting more nearly fulfills his needs. In any event, either an arc or an oxyacetylene cutting process will permit a fabricator to cut heavier sections than the capacity of his shearing equipment.

Stack Cutting Thin Sheets

Where many thin stainless-steel sheets are to be cut, stack cutting is often used. Because of the high heat reaction, it is not necessary to clamp the sheets tightly together as in the stack cutting of carbon-steel sheets or plates. It has been found that the reaction will jump over most ordinary gaps. As a consequence, all sheets below the topmost have an extremely clean edge. With thicker materials, it has been found that beveled edges are as easily produced as square edges.

Effects of Heat

Since any cutting process subjects a stainless steel to extreme heat, it is natural to ask just what effects the cutting will have upon the base metal.

With austenitic steels, the intergranular corrosion found after welding also occurs after cutting in areas where the material has been held above the critical temperature level. The intergranular corrosion may take the form of a zone of carbide precipitation about ¼ in. from the cut. As told elsewhere in this issue, the corrosion resistance of stainless is determined by the percentage of chromium, which must be above 12% to be effective. The critical temperature for the austenitic steels is between 700 and 1,600 F. in which range the carbon may precipitate as chromium carbide along grain boundaries. This may reduce the chromium content at these boundaries to the point where stainless properties are lost, resulting in intergranular corrosion.

In flame-cutting steels of the 400 series; *i.e.*, the hardenable types, the problem is a little different. Here a hardening of the cut surface is the natural result. In cutting these hardenable steels, care must be exercised to prevent cracking.

The effects of carbide precipitation may be reduced by using a water quench preceding and following the point of cutting. The quench restricts the area of the plate that is heated to a critical temperature and limits the time in which the critical range occurs. In view of these facts, it seems that the best way to limit carbide precipitation is to confine the cutting to a steel that has a high chromium content and use quenching jets to hold down the temperature.

Despite some of the problems that arise, the arc and oxyacetylene methods of cutting stainless steels are of tremendous value and advantage to steel fabricators, warehousers and users of stainless steel products. As we pointed out earlier, the user will have to choose the process he prefers. Acceptable results are generally obtained by all of these processes.

Philadelphia Preview*

Can you afford not to travel to Philadelphia this October? Maybe you can, but we doubt it. Here is a glimpse of the things you will miss if you stay away.

BY CLYDE B. CLASON

IT's Philadelphia this year! The historic city where the continental congress met to draft the Declaration of Independence will be the scene of the 33rd annual convention of the American Welding Society. The meeting place is the Bellevue-Stratford Hotel; the time from Monday Oct. 20 through Friday Oct. 24.

This year's convention program promises to be moderate in the number of scheduled events. There are, for example, only 21 technical sessions, at which 66 papers will be given, as compared to the 70 papers presented at last year's Detroit meeting.

A welcome innovation in programming is the scheduling of the Adams lecture and prize award session for Monday morning. For some years now these important events have been allotted an evening period, and the attendance has left much to be desired. The Adams lecture should prove a particularly big drawing card this year as it is on a subject of timely interest: the welding and brazing of titanium alloys. The lecturer is C. B. Voldrich, of Battelle Memorial Institute, Columbus, O.

Other special events are the president's reception, scheduled for Monday night, and the annual banquet on Thursday night. According to the Association's tentative program, the remaining evenings of the week are free—for visits to the Metal Show or what have you?

The popular Educational Lecture series will be repeated this year. It is scheduled for Tuesday and Wednesday afternoons at 4:30 p.m., under the chairmanship of Professor Gilbert E. Doan, Lehigh University. Both lectures are on the inert-gas metal-arc welding processes and both will be given by Walter H. Wooding, of Philadelphia Naval Shipyard.

Plant Tours

Some interesting plant tours have been arranged. One is a tour of either the Philadelphia Naval Shipyard or the Naval Air Materiel Center, as preferred, on Wednesday morning, October 22. The shipyard tour will include a trip through the structural shop to witness the fabrication of ship assemblies of steel and of aluminum. The Air Materiel Center tour will include a view of a catapult shooting a dead test load, a demonstration of a pilotless helicopter and a fire-fighting show as well as observation of forming, fitting and joining practices.

Another major tour, also scheduled for Wednesday morning, is to the steam division of the Westinghouse Electric Corp. at Lester, Pa. The latest fabrication techniques of submerged-arc welding and low-frequency induction heating for the stress relieving and preheating of weldments will be displayed. This tour will show the latest methods and materials that are used in the production of steam turbines for power stations.

All tours will be restricted, and visitors must comply with Navy regulations.

1952-1953 Officers

Fred L. Plummer, director of engineering, Hammond Iron Works, Warren, Pa., has been elected president of the American Welding Society for 1952-1953. Mr. Plummer, who takes office during the annual meeting, was formerly first vice-president. He is the author of two books and more than 30 technical articles published in technical journals.

Eric R. Seabloom, supervisor of field engineering, Crane Co., Chicago, moves up from second vice-president to first vice-president. Mr. Seabloom was born in Sweden and came to the United States in 1909. He has published many papers on welding and presented numerous talks, mostly on welding, before AWS local sections and other engineering groups.

J. H. Humberstone, vice-president of Air Reduction Co., Inc., has been elected second vice-president of the American Welding Society. Mr. Humberstone was vice-president in charge of operations of the Arcrods Corp. when he accepted a position as manager of apparatus production of Air Reduction Co., Inc., in 1948. He continued his association with Arcrods, subsequently becoming president and later chairman of the board. He is the author of many technical papers on metal-arc welding electrodes.

District vice-presidents: J. E. Dato, assistant manager, process service, at Kansas City, Mo., for the Linde Air Products Co. has been elected vice-president of the mid-southern district (No. 6) for a two-year term.

John H. Blankenbuehler, design engineer, Hobart Brothers Co., Troy, O., has been elected vice-president of the central district (No. 4) for a two-year term.

Donald B. Howard, metallurgist, American Car & Foundry Co., Berwick, Pa., has been elected vice-president of the middle eastern district (No. 2).

Directors: Harold R. Pratt has been elected to the board of directors (member at large) for a three-year

*Independence Hall and Liberty Bell photos reproduced through courtesy of Convention and Visitors' Bureau of the Chamber of Commerce of Greater Philadelphia.

Newly Elected Officers of the American Welding Society . . .

F. L. PLUMMER
1952-1953 president

ERIC SEABLOOM
First vice-president

J. H. HUMBERSTONE
Second vice-president

D. B. HOWARD
District No. 2 V.P.

J. BLANKENBUEHLER
District No. 4 V.P.

term. Mr. Pratt is principal surveyor for the American Bureau of Shipping at Portland, Ore., and is a licensed professional engineer in the State of Oregon.

Isadore Morrison has been elected a member at large of the board of directors to serve for a three-year term. He is vice-president of Morrison Steel Products, Inc., Buffalo, N. Y.

Gairald H. Garrett has been elected a director-at-large for a three-year term. He is vice-president of the Thompson Pipe & Steel Co., Denver, Colo.

Monro B. Lanier, president of the Ingalls Shipbuilding Corp., Pascagoula, Miss., has been elected a director-at-large for a term of three years.

Technical session periods are: Monday afternoon, Tuesday morning and afternoon, Wednesday morning and afternoon, Thursday morning and Friday morning. No technical sessions are scheduled for Monday morning, Thursday afternoon or Friday afternoon. Let's skim over the tentative program.

Inert-Arc Welding

There will be two sessions on inert-arc welding, scheduled for Thursday and Friday. C. I. MacGuffie, General Electric Co., is chairman of the Thursday morning session, and K. L. Walker, of Foster Wheeler Corp., is co-chairman. Papers to be given are:

A comparison of shielding mixtures for gas-shielded arc welding, by John W. Cunningham and Harry C. Cook, Air Reduction Sales Co.

Production welding of mild and low-alloy steels by gas-shielded arc welding, by Gilbert Rothschild and John H. Berryman, Air Reduction Sales Co.

Porosity in mild-steel weld metal, by Donald Warren, E. I. duPont de-Nemours & Co., and R. D. Stout, Lehigh University.

C. D. Evans, International Harvester Co., is chairman of the Friday morning session. N. E. Wheeler, G.M.C. Truck and Coach Div., is co-chairman. The three papers are:

Inert-gas shielding of the metallic arc, by William L. Green and Robert J. Krieger, The Ohio State University, Columbus, O.

Gas flow requirements for inert-gas arc shielding, by Glenn J. Gibson, Air Reduction Co., Inc.

Shielded arc welding of jet-engine components, by K. H. Koopman, Linde Air Products Co.

Oxyacetylene Processes

Gas welding, cutting and hardening processes will be discussed at two sessions. The first of these, on Monday afternoon, will be devoted to the rather dissimilar topics of hard-facing and flame-hardening. E. H. Roper, Air Reduction Sales Co., is chairman, and R. A. Guenzel, Southern Oxygen Co., is co-chairman. Papers are:

Hard-facing alloys of the chromium-carbide type, by Howard S. Avery and Henry J. Chapin, American Brake Shoe Co.

Selection and evaluation of methods of hard-facing, by Jack J. Barry, Air Reduction Sales Co.

Flame-hardening of large-diameter thin-wall cylindrical shells, by G. S. Wing and G. A. Weber, M. W. Kellogg Co.

A session combining the two topics of maintenance and gas cutting will be held on Wednesday afternoon. H. V. Inskeep, Linde Air Products Co., is chairman, and A. M. Garcia, Morris, Wheeler & Co., Inc., is co-chairman. Only two papers are scheduled:

Wear and operation problems in maintenance, by Frank J. Gaydos, United States Steel Co., Gary Works.

Effect of oxygen cutting on alloy steel, by F. C. Saacke, Air Reduction Co., Inc.

Resistance Welding

There will be three sessions on resistance welding—Monday afternoon, Tuesday morning, Tuesday afternoon—at which a total of nine papers will be given. Only one other session title has more periods and more papers allotted to it—weldability.

T. Embury Jones, Precision Welder & Machine Co., is chairman of the Monday afternoon resistance welding session, and J. J. MacKinney, Budd Co., is co-chairman. Papers are:

Corrosion of structural spot welds, by B. Karnisky, E. P. Gruca and E. Kinelski, Pullman-Standard Car Mfg. Co.

Maintenance of resistance welders in high-speed assembly lines, by James F. Salatin and O. D. Etchison, Delco-Remy Division, General Motors.

Jack Ogden, Fisher Body Division, General Motors, is chairman of the Tuesday morning session. K. W. Ostrom, of K. W. Ostrom & Co., is co-chairman. There are four papers:

Expression of spot-weld properties, by Julius Heuschkel, Westinghouse Electric Corp.

Temperature distribution during

J. E. DATO
District No. 6 V.P.

H. R. PRATT
Director-at-large

I. MORRISON
Director-at-large

G. H. GARRETT
Director-at-large

M. B. LANIER
Director-at-large

flash welding of steel (Part II), by Ernest F. Nippes, Warren F. Savage, John J. McCarthy and Sheridan S. Smith—all of Rensselaer Polytechnic Institute.

Spot welding of titanium alloy sheet, by M. L. Begeman, Edwin H. Block, Jr., and Frank W. McBee, Jr., The University of Texas.

Spot welding magnesium with three-phase, low-frequency equipment, by Dean L. Knight and Paul Thorne, of National Electric Welding Machines Co., and Paul Klain, of Dow Chemical Co.

J. H. Cooper, of Taylor-Winfield Corp., is chairman of the Tuesday afternoon session. W. G. Fetter, of P. R. Mallory & Co., is co-chairman. Papers are:

Quality control of resistance welding by statistical methods, by J. F. Radford and R. K. Waldvogel, Crosley Division, Avco Mfg. Corp.

Contact resistance, by William B. Kouwenhoven, The Johns Hopkins University, and Clarence W. Little, Jr., Allis-Chalmers Mfg. Co.

New multispot control provides increased welding production with limited power supply, by Claude R. Whitney, Jr., Square D Co.

Brazing and Braze Welding

The closely related topics of brazing, braze welding and soldering will be discussed at two sessions. J. J. Vreeland, Chase Brass & Copper Co., is chairman at the first of these, held on Tuesday afternoon. L. H. Hawthorne, Revere Copper & Brass, Inc., is co-chairman. Papers are:

New aspects in surface alloying in brazing and related techniques, by Dr. Robert Humphrey and René D. Wasserman, Eutectic Welding Alloys.

Strength joints to steel with aluminum-bronze filler metals, by Willis G. Groth, Ampco Metal, Inc.

A. N. Kugler, Air Reduction Co., Inc., is chairman at the Thursday morning session. A. M. Setapen, Handy & Harman, is co-chairman. Papers are:

Advanced information for the brazing operator, by E. F. Davis, Westinghouse Electric Corp.

Joint design for brazing, by W. J. Van Natten, General Electric Co.

Technical aspects of soldering practices, by R. M. MacIntosh, Tin Research Institute, Inc.

Production brazing, by J. R. Wirt, Delco-Remy Division, General Motors Corp.

Non-Ferrous Materials

The welding of aluminum, cupro-nickel alloy and titanium will be discussed at two sessions on the non-ferrous metals. O. B. J. Fraser, of International Nickel Co., is chairman of the session on Wednesday morning. J. R. Hunter, Westinghouse Electric Corp., is co-chairman. Papers are:

Semiautomatic inert-gas metal-arc welding of aluminum alloys, by Charles T. Gayley, Joseph R. Girini and Walter H. Wooding, industrial test laboratory, Philadelphia Naval Shipyard.

Welding 90-10 cupro-nickel by the inert-gas shielded arc processes, by L. H. Hawthorne, Revere Copper and Brass, Inc.

Weld cracking of aluminum alloys, by James D. Dowd, Aluminum Company of America, Pittsburgh, Pa.

The non-ferrous program continues on Wednesday afternoon. G. O. Hoglund, Aluminum Company of America, is chairman of the second session. J. S. Douglass, Linde Air Products Co., is co-chairman. Afternoon papers are:

Strength and ductility of welds in aluminum-alloy plate, by F. M. Howell and F. G. Nelson, Jr., Aluminum Research Laboratories.

Factors that determine the performance of aluminum-alloy weldments, by W. R. Apblett, Jr., C. R. Felmley and W. S. Pellini, Naval Research Laboratories.

Welding and forming of titanium, by Francis H. Stevenson, Aerojet Engineering Corp.

Titanium Session

In addition to the non-ferrous sessions, a special session on titanium alloys will be held on Wednesday morning. Colonel B. S. Mesick, Ordnance Corps, Watertown Arsenal, is chairman, and Carl E. Hartbower, also of Watertown Arsenal, is co-chairman. Papers are:

Practical aspects of arc welding titanium alloys, by J. J. Chyle and Ivan Kutuchief, A. O. Smith Corp.

Effects of Fe, Mn, Cr and Mo on welds in titanium, by G. E. Faulkner, G. B. Grable and C. B. Voldrich, Battelle Memorial Institute.

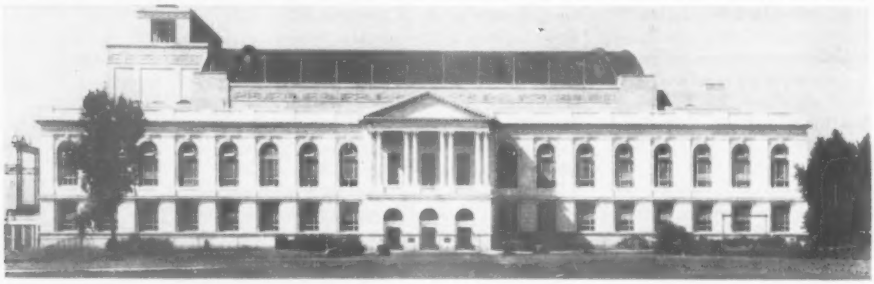
An investigation of the thermal cycles adjacent to arc welds in ½-in. titanium plate, by E. F. Nippes, J. M. Gerken and B. W. Schaaf, Rensselaer Polytechnic Institute.

Contaminants in welding titanium,

(Continued on page 79)

Courtesy Philadelphia Convention and Visitors' Bureau

CONVENTION HALL (top) and adjacent Commercial Museum, Philadelphia, scene of the coming Metal Show



A Royal Welcome Awaits You

They will, literally, roll out the red carpet for you when you visit the 34th Metal Show. To bring yourself up-to-date, plan to come to Philadelphia.

WHEN visitors to the 34th Metal Show arrive at the Philadelphia Convention Halls during the five-day period between Oct. 20 and Oct. 24, one of the first things that they will notice will be a bright-red carpet. It's a carpet that is a carpet, stretching for 1½ miles through the aisles of the exhibition, and it will be laid upon a backing of foam rubber, making every step a step of real comfort.

Remember how the old dogs used to ache from pounding the hard concrete? No more of that. Now you can walk for hours without your feet getting sore. What more can you ask in the way of luxury?

Five Acres of Exhibits

If you wish to be an exhibitor but haven't yet signed up, you are probably out of luck. All of the exhibit space was reported to have been sold out as long ago as last June. Some 210,000 sq ft of floor space—nearly five acres—will be utilized for the display and demonstration of products, equipment and services. The list of exhibitors includes over 400 firms engaged in: (a) the production of metals, (b) the treatment of metals, (c) the fabrication of metals or (d) rendering services to any or all of these branches. A few of the exhibitors who are of particular interest to the welding industry will be listed at the end of this article.

The theme of this year's Metal Show (more formally known as the National Metal Congress and Exposition) is "Metal Keeps the Peace." Its purpose is to bring together the experience, the knowledge and the means for a more effective use of metals in the making of products for civilian use and to insure our defense against aggression.

Four technical societies will hold their annual national conventions in

(Continued on page 82)

Take the problem out of welding problem steels!

Use P&H Low-Hydrogen Electrodes

The right low-hydrogen electrode for your job!

70LA-2 (E6016, E7016)
General-purpose electrode for high-carbon, low-alloy, high-tensile, and high-sulfur free-machining steels.

70LB (E7016)
For repair welding of Grade B and other castings of similar analysis.

P&H .25C (E7016)
For castings repair where high carbon is preferred to alloys for raising tensile strength.

75LP (E8016)
For 2% to 3% nickel steels, both cast and rolled.

80LP (E8016)
For chrome-moly power piping and fittings.

90LE (E9016)
For higher-analysis chrome-moly power piping and fittings.

P&H .40C (E9015)
For .40 carbon castings and rolled steels where you want to match both chemical and mechanical properties.

AW2B (E9016)
For repair welding of cast armor, "off-analysis" steels, rerolled rail steels, and high-sulfur steels.

P&H # 7 (E9016)
For repair welding of Grade C and other castings of similar analysis.

90LH-2 (E10016)
For alloy steels, such as SAE 8630, 4130, and comparable types where the weld metal must match the heat-treating properties of the parent metal.

P&H # 12 (E10016)
For difficult fabricating jobs involving high-tensile and alloy steels with little or no preheat.

P&H # 17 (E12016)
For high-hardenable steels subject to high impacts through a wide temperature range.

P&H # 21 (E15016)
For aircraft and similar steels, such as 4340 and 4130.

. . . . and get high-strength welds that are free of underbead cracking

P&H has the most complete line of low-hydrogen electrodes in the industry — many "custom-made" to match the chemical analysis or heat-treating properties of a variety of alloy steels. This wide selection eliminates the difficulties in welding problem steels, such as high-sulfur free-machining, high-carbon, low-alloy, and high-strength steels.

The core wire of these electrodes is of a mild steel or a low alloy, thereby greatly reducing the cost of the low-hydrogen electrode, as compared to the higher-alloy types.

The coating ingredients of these P&H electrodes are mineral- and also hydrogen-free, with low moisture content. This eliminates underbead cracking and permits the welding of "difficult" steel with little or no preheating.

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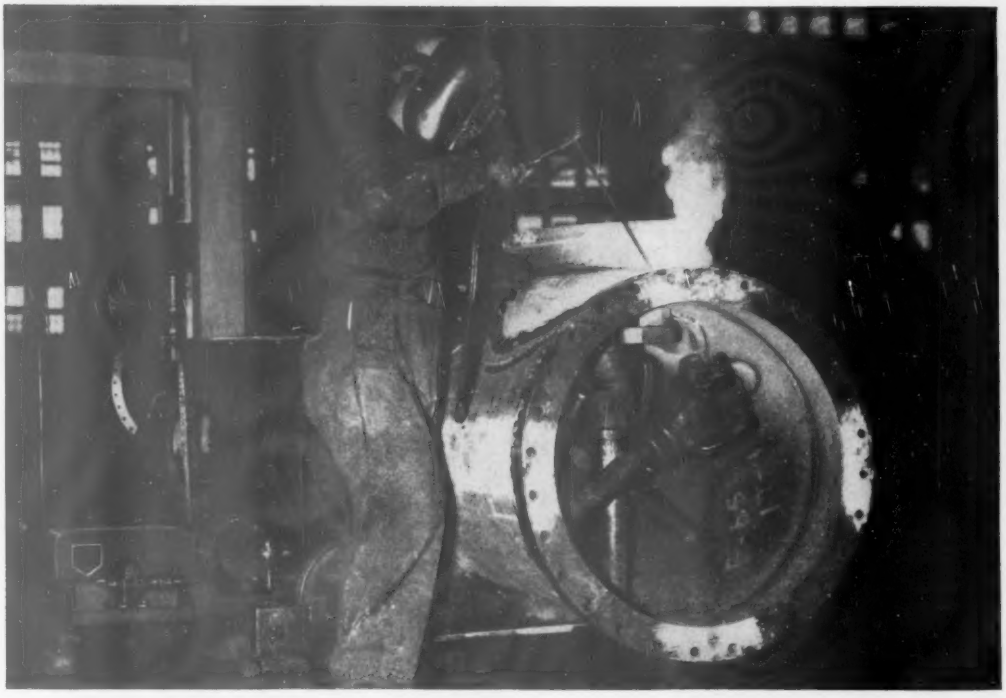


This welder can weld up to 50% more than he used to!

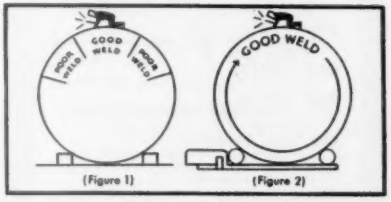
With Worthington turning rolls any welder can get better welds and turn out real footage

No problem to boost welding footage as much as 50% when you use Worthington Turning Rolls.

Previously the welder was forced to waste lots of time by having to crawl over cylindrical vessels, turn them by hand or wait for crane and hoist service.

With Worthington Turning Rolls at work his footage is soaring and he produces neater, stronger welds with less effort. Now, *power* turns the vessel at any selected welding speed as he quickly spots longitudinal seams or continuously welds circumferential seams.

To find out where you can see a nearby Worthington Turning Roll, just ask us. For more data, ask for Bulletin 228. Worthington Corporation, Plainfield, N. J.



(Figure 1) (Figure 2)

WHY WORTHINGTON TURNING ROLLS INSURE BETTER WELDS

Unless the work is turned continuously, good downhand welding is obtainable only in small area (Fig. 1). With a Worthington Turning Roll, downhand welding is assured for the complete circumferential seam (Fig. 2) as well as all longitudinal seams (either by manual or automatic welding).

Y.2.1

ELECTRODE COMPARISON CHART I

Stainless Electrode Type No.[1]	ASTM-AWS Spec. No.	Air Reduction Sales Co. Airco[5]	Arcos Corp.	Alloy Rods Co.	Champion Rivet Co. Champion[10]	Eutectic Welding Alloys Corp.	General Electric Co. G-E[11]	Harnischfeger Corp.	Hobart Bros. Co Hobart[15]
307 (15)[2]		19-9 Mn (DC)		Armorarc B Armorarc C	307 B-1		W-1307	AW3C-L	
307 (16)[3]		19-9 Mn (AC-DC)		Armorarc Mn	307 MN-2		W-2307	AW3C-T	
308 (15)	E308-15	19-9 (DC)	Chromend K	Arcaloy 308 Lime	308-1	Eutec-StainTrode B (DC)	W-1308	Harstain 18-8	308 DC
308 (16)	E308-16	19-9 (AC-DC)	Stainlend K	Arcaloy 308 AC-DC	308-2	Eutec-StainTrode B (AC-DC)	W-2308	Harstain "A" 18-8	308 AC-DC
308 ELC[4] (15)		19-9 ELC (DC)[6]	Chromend K-LC		308 CF-1		W-1308 ELC		
308 ELC (16)		19-9 ELC (AC-DC)[6]		Arcaloy 308 ELC AC-DC	308 CF-2		W-2308 ELC		
309 (15)	309-15	25-12 (DC)	Chromend HC[7]	Arcaloy 309 Lime	309-1	Eutec-StainTrode C (DC)	W-1309	Harstain 25-12	309 DC
309 (16)	309-16	25-12 (AC-DC)	Stainlend HC[7]	Arcaloy 309 AC-DC	309-2	Eutec-StainTrode C (AC-DC)	W-2309	Harstain "A" 25-12	309 AC-DC
309 Cb (15)		25-12 Cb (DC)	Chromend 25/12 Cb	Arcaloy 309 Cb Lime			W-1309 Cb		
309 Cb (16)		25-12 Cb (AC-DC)	Stainlend 25/12 Cb	Arcaloy 309 Cb AC-DC			W-2309 Cb		
310 (15)	310-15	25-20 (DC)	Chromend HCN	Arcaloy 310 Lime	310-1		W-1310	Harstain 25-20	310 DC
310 (16)	310-16	25-20 (AC-DC)	Stainlend HCN	Arcaloy 310 AC-DC	310-2		W-2310	Harstain "A" 25-20	310 AC-DC
310 Cb (15)		25-20 Cb (DC)	Chromend HCN (Hi-Carbon)[7]	Arcaloy 310 Cb Lime	310 Cb-1		W-1310 Cb		
310 Cb (16)		25-20 Cb (AC-DC)	Chromend 25/20 Cb	Arcaloy 310 Cb AC-DC	310 Cb-2		W-2310 Cb		
310 Mo (15)		25-20 Mo (DC)	Chromend 25/20 Mo	Arcaloy 310 Mo Lime	310 Mo-1		W-1310 Mo		
310 Mo (16)		25-20 Mo (AC-DC)		Arcaloy 310 Mo AC-DC	310 Mo-2		W-2310 Mo		
312 (15)		29-9 (DC)[6]	Chromend 29/9	Arcaloy 312 Lime	312-1		W-1312		
312 (16)		29-9 (AC-DC)[6]		Arcaloy 312 AC-DC	312-2		W-2312		
316 (15)	316-15	18-12 Mo (DC)	Chromend K Mo	Arcaloy 316 Lime	316-1	Eutec-StainTrode A (Moly) (DC)	W-1316	Harstain 18-8-2 Mo	316 DC
316 (16)	316-16	18-12 Mo (AC-DC)	Stainlend K Mo	Arcaloy 316 AC-DC	316-2	Eutec-StainTrode A (Moly) (AC-DC)	W-2316	Harstain "A" 18-8-2 Mo	316 AC-DC
316 Cb (15)		18-12 Mo Cb (DC)							
316 Cb (16)		18-12 Mo Cb (AC-DC)							
316 ELC[4] (15)			Chromend K Mo-LC[9]				W-1316 ELC		
316 ELC (16)							W-2316 ELC		
317 (15)	317-15	18-12 3.5 Mo (DC)		Arcaloy 317 Lime	317-1		W-1317	Harstain 18-8-3 Mo	
317 (16)	317-16	18-12 3.5 Mo (AC-DC)		Arcaloy 317 AC-DC	317-2		W-2317	Harstain "A" 18-8-3 Mo	
318 (15)			Chromend K Mo Cb	Arcaloy 316 Cb Lime			W-1316 Cb		
318 (16)				Arcaloy 316 Cb AC-DC			W-2316 Cb		
330 (15)		35 Ni-15 Cr (DC)	Chromend 15/35	Arcaloy 330 Lime	330-1		W-1330		330 DC
330 (16)		35 Ni-15 Cr (AC-DC)		Arcaloy 330 AC-DC	330-2		W-2330		330 AC-DC
330 HC[7] (15)		35 Ni-15 Cr Modified (DC)[6]		Arcaloy 330 HC Lime			W-1332		
330 HC (16)				Arcaloy 330 HC AC-DC					
347 (15)	347-15	19-9 Cb (DC)	Chromend 19/9 Cb	Arcaloy 347 Lime	347-1	Eutec-StainTrode A (DC)	W-1347	Harstain 18-8 Cb	347 DC
347 (16)	347-16	19-9 Cb (AC-DC)	Stainlend 19/9 Cb	Arcaloy 347 AC-DC	347-2	Eutec-StainTrode A (AC-DC)	W-2347	Harstain "A" 18-8 Cb	347 AC-DC
349 (15)		19-9 W Mo (DC)[6]	Chromend 19/9 W Mo	19-9 W Mo Lime	349 Mo-1		W-1349		
349 (16)		19-9 W Mo (AC-DC)[6]		19-9 W Mo AC-DC	349 Mo-2		W-2349		
410 (15)	410-15	12 Cr (DC)	Chromend 12	Arcaloy 410 Lime	410-1		W-1410		
410 (16)	410-16			Arcaloy 410 AC-DC	410-2				
430 (15)	430-15	16 Cr (DC)	Chromend 16	Arcaloy 430 Lime	430-1		W-1430		
430 (16)	430-16			Arcaloy 430 AC-DC	430-2				
442 (15)			Chromend 18	Arcaloy 442 Lime	442-1				
442 (16)				Arcaloy 442 AC-DC	442-2				
446 (15)		28 Cr (DC)	Chromend 28	Arcaloy 446 Lime	446-1		W-1446		
446 (16)				Arcaloy 446 AC-DC	446-2				
502 (15)	502-15	4-6 Cr Mo (DC)	Chromend 5M[9]	Arcaloy 502 Lime	502-1	EutecTrode #6H	W-1502		
502 (16)	502-16			Arcaloy 502 AC-DC	502-2				
505 (15)		9 Cr-1 Mo (DC)	Chromend 9 M[9]				W-1505		
505 (16)									

[1]Generally this type number corresponds with the AISI type number or would carry such numbers were there an AISI designation.

[2]An electrode having a (15) designation is known as a "lime-type" for use on d-c, reverse polarity, all-position.

[3]An electrode having a (16)

[4]ELC: abbreviation for extra

T FOR STAINLESS-STEEL ELECTRODES

lobart os. Co. obart[12]	Lincoln Electric Co.	McKay Co.	Metal & Thermit Corp.	Maurath, Inc. Maurath[13]	National Cylinder Gas Co.	Page Steel & Wire Div. Page-Allegheny[14]	Reid-Avery Co. Racolloy[15]	A. O. Smith Corp. Smithway[16]	Universal Welder Corp.	Westinghouse Electric Corp. Flexarc[17]
		Armorloy A-8	Armorweld 8			Armorweld	307	SW-164		307 Lime
										307 Lime-Titania
DC	Stainweld A5	18-8 DC Lime	M&T 19-9	18-8 S DC Lime	Sureweld 19-9	308 DC	308 Lime	SW-162	Stainarc A	308 Lime
AC-DC	Stainweld A7	18-8 AC-DC	Type 308	18-8 S AC-DC		308 AC-DC	308 Titania	SW-362		308 Lime Titania
		18-8 ELC DC Lime	M&T 19-9 / Murex 19-9				308 ELC	SW-262		
		18-8 ELC AC-DC								
DC		25-12 DC Lime	M&T 25-12		Sureweld 25-12	309 DC	25-12	SW-166	Stainarc G	309 Lime
AC-DC		25-12 AC-DC	Type 309	309 AC-DC		309 AC-DC				309 Lime-Titania
	Stainweld B Cb	25-12 Cb DC Lime	M&T 25-12 Cb				25-12 Cb	SW-167		309 Cb Lime
		25-12 Cb AC-DC	Type 309 Cb	309 CB						309 Cb Lime-Titania
DC	Stainweld D	25-20 DC Lime	M&T 25-20		Sureweld 25-20	310 DC	25-20 Lime	SW-159	Stainarc J	310 Lime
AC-DC		25-20 AC-DC	Type 310			310 AC-DC	25-20 Titania	SW-359		310 Lime-Titania
		25-20 Cb DC Lime	M&T 25-20 Cb				25-20 Cb	SW-169		310 Cb Lime
		25-20 Cb AC-DC	Type 310 Cb	310 AC-DC						
		25-20 Mo DC Lime	M&T 25-20 Mo				25-20 Mo	SW-168		310 Mo Lime
		25-20 Mo AC-DC	Type 310 Mo					SW-368		310 Mo Lime-Titania
		29-9 DC Lime	M&T 29-9 Type 312							312 Lime
		29-9 AC-DC								312 Lime-Titania
DC		18-8 Mo (316) DC Lime	M&T 18-8 Mo			316 DC	18-12 (2-3 Mo)	SW-160	Stainarc C	316 Lime
AC-DC		18-8 Mo (316) AC-DC	Type 316	316 AC-DC		316 AC-DC				316 Lime-Titania
	Stainweld C Cb		M&T 18-8 Mo Cb							
			Type 316 Cb							
							18-12 Mo ELC	SW-260		
		18-8 Mo (317) DC Lime	M&T 18-8-3 Mo		Sureweld 19-9 Mo	317 DC	19-12 (3-4) Mo	SW-161	Stainarc D	317 Lime
		18-8 Mo (317) AC-DC	Type 317	317 AC-DC		317 AC-DC				317 Lime-Titania
		18-8 Mo Cb DC Lime	M&T 18-8 Mo Cb				18-12 Cb	SW-158		318 Lime
		18-8 Mo Cb AC-DC		318 AC-DC						318 Lime-Titania
DC		15-35 DC Lime	M&T 15-35	330	Sureweld 15-35	330 DC	330		Stainarc U	330 Lime
AC-DC		15-35 AC-DC				330 AC-DC				
DC	Stainweld A5 Cb	18-8 Cb DC Lime	M&T 19-9 Cb	347	Sureweld 19-9 Cb	347 DC	18-8 Cb Lime	SW-157	Stainarc B	347 Lime
AC-DC	Stainweld A7 Cb	18-8 Cb AC-DC	Type 347			347 AC-DC	18-8 Cb Titania	SW-357		347 Lime-Titania
										349 Lime
										349 Lime-Titania
		12 Cr DC Lime	M&T 12 Cr	410		410 DC	410	SW-153	Stainarc M	410 Lime
		12 Cr AC-DC				410 AC-DC				
		16 Cr DC Lime	M&T 16 Cr			430 DC	430	SW-154	Stainarc N	430 Lime
		16 Cr AC-DC				430 AC-DC				
		18 Cr DC Lime	M&T 18 Cr	442						
		18 Cr AC-DC								
		28 Cr DC Lime	M&T 28 Cr	446		446 DC				446 Lime
		28 Cr AC-DC				446 AC-DC				
		5 Cr Mo DC Lime	M&T 4-6 Cr	502		502 DC	502	SW-151	Stainarc Y	502 Lime
		5 Cr Mo AC-DC				502 AC-DC				
			M&T 9 Cr Mo					SW-152		

g a (16) designation is a titania type and an a-c, d-c electrode for all-position welding.
for extra-low-carbon.

[6]Airco prefix.
[7]Special product usually made to order.
[8]HC: abbreviation for high carbon.
[9]LC: abbreviation for low carbon.
[10]Lime-titania coating.
[11]Champion prefix.
[12]G-E prefix.
[13]Hobart prefix.
[14]Maurath prefix.
[15]Page-Allegheny prefix.
[16]Racolloy prefix.
[17]Smithway prefix.
[18]Flexarc prefix

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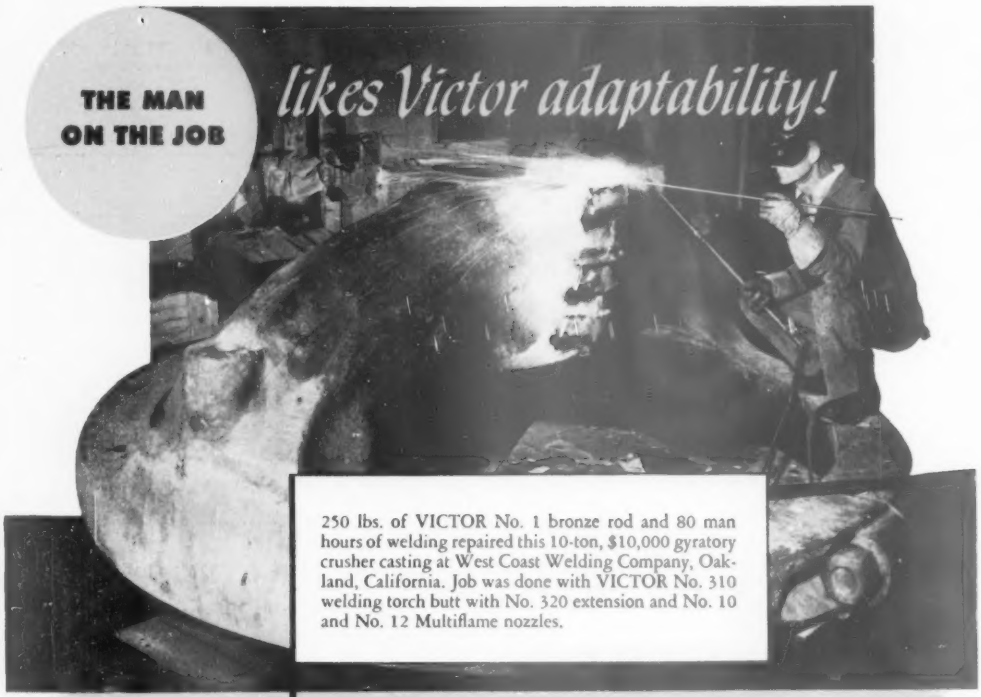

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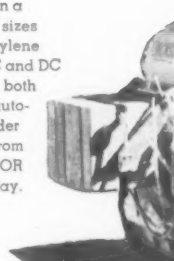

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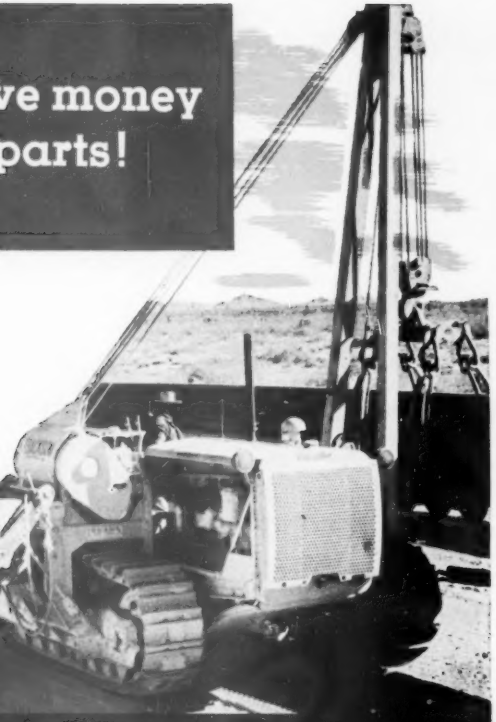

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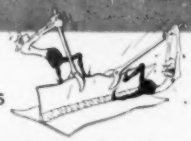
minimize stress  ...distortion ...warpage with Low Temperature EUTECTIC WELDING ALLOYS

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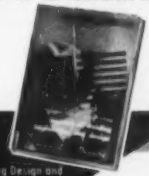

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PHILADELPHIA PREVIEW

(Continued from page 69)

by R. W. Huber and Thomas R. Graham, Bureau of Mines.

Structural and Fabricating

A structural session will be held on Tuesday morning under the chairmanship of LaMotte Grover, Air Reduction Sales Co. I. E. Boberg, Chicago Bridge & Iron Co., will serve as co-chairman. Papers are:

Behavior of welded portal frames, by E. R. Johnston, Lynn S. Beedle, Fritz Engineering Lab., Lehigh University, and J. M. Ruzek, of C. F. Braun & Co.

Residual stress and the compressive strength of steel, by Lynn S. Beedle and A. W. Huber, of Fritz Engineering Lab., Lehigh University, and Bruce G. Johnston, University of Michigan.

How to save cost by designing for structural welding, by Alfred E. Pearson, The Ingalls Iron Works Co.

Distortion control in structural fabrication, by Gordon Cape and Llewellyn Jehu, Dominion Bridge Co., Ltd.

A session on fabricating procedures will be held on Monday afternoon. Fred L. Plummer, Hammond Iron Works, is chairman, and H. C. Campbell, Arcos Corp., co-chairman. Papers are:

Fusion welding techniques for jet-aircraft components, by Arnold S. Rose and Morton A. Braun, I. T. E. Circuit Breaker Co.

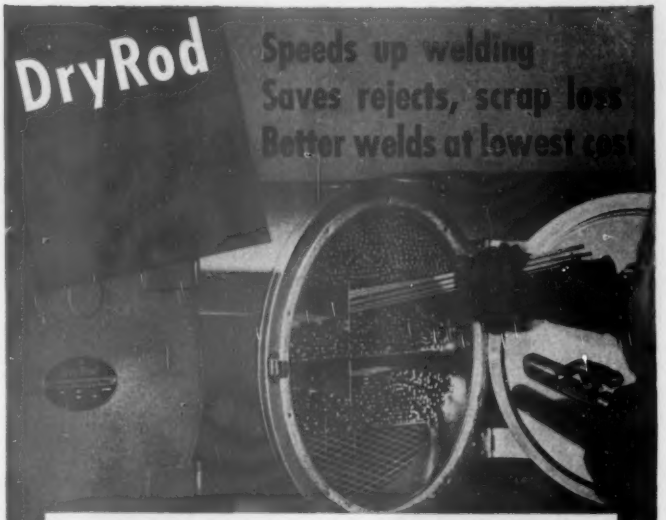
Should preheat be substituted for high-temperature stress relief in the codes?, by E. Paul DeGarmo, University of California.

Chromium recovery during submerged-arc welding, by James G. Kerr, and David A. Elmer, of C. F. Braun & Co.

Pipe and Marine Work

A session on pipe welding will be held Friday morning under the chairmanship of a man who knows a great deal about this subject—Eric R. Seabloom, of the Crane Co., Chicago. A. J. Erlacher, United Engineers & Constructors, will serve as co-chairman. Papers are:

Pipe welding in the petroleum refining industry, by Albert W. Zeuthen, Socony Vacuum Oil Co.



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Unpackaged welding electrodes (low hydrogen, stainless steel types) pick up moisture fast. Within 2 hours, rods exceed U. S. Govt. limit of .2% . . . within 24 hours moisture absorption may exceed 5.2%! Moist electrodes are responsible for most welding headaches — rough welds, X-Ray porosity, under-bead cracking. Resulting reworking, rejects, rod scrap often cost you many dollars per day. Assure yourself better quality welds . . . for less than a dime per day operating cost. Protect electrodes with Dry-Rod, the *original* Electrode Oven. See your welding supply dealer or write direct for details.

***DryRod*—always made by, and now also sold by PHOENIX**

X-DR-5, DryRod—Trademark, Type 300

Phoenix Products Co.
Milwaukee 16 Wisconsin

DryRod *Electrode Oven*

***DryRod*—always made by, and now sold by PHOENIX**

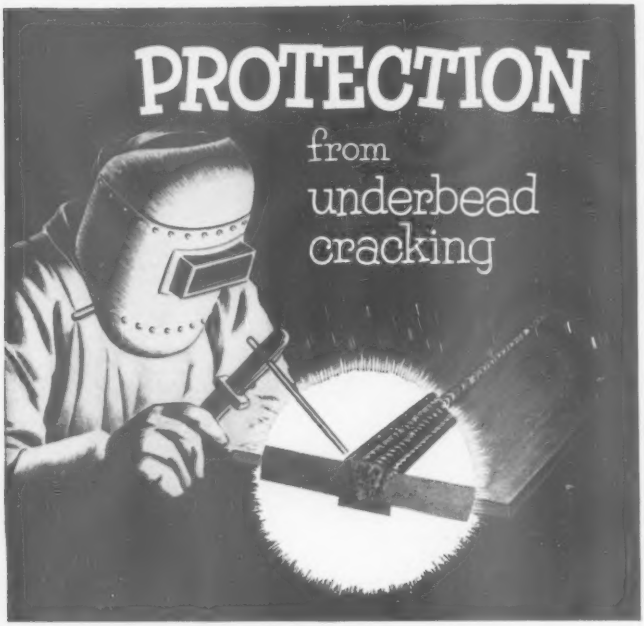
WRITE FOR FULL INFORMATION

Phoenix Products Company
4715 N. 27th St., Milwaukee 16, Wis.

Clip coupon, attach to letterhead or mail direct for new bulletin DR-2.

Name.....
Firm.....
Address.....
City.....Zone..State.....

X-DR-5



Use ARCOS Low Hydrogen Electrodes

ARCOS GRADE	A.W.S. SPEC.
Tensilend 70	E7016
Tensilend 100	E10016
Tensilend 120	E12015
Manganend 1M	E9015
Manganend 2M	E10015
Nickend 2	E8015
Chromend 1M	E8015
Chromend 2M	E9015

With Arcos Low Hydrogen Electrodes you can produce sound weld metal without the need for preheat or post heat frequently required with mild steel electrodes. Correct selection and blending of coating ingredients, and controlled-cycle, high temperature baking produce a moisture-controlled coating that safely minimizes the gases released in welding.

The moisture-proof wrapping on every 5 and 10 lb. package in a box of electrodes prevents moisture pick-up in shipment and storage.

Added together, these Arcos "quality controls" assure you consistently sound weld metal on every high tensile steel application. ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Pa.

WELD WITH

ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

Arc welding of low chromium-molybdenum steel pipe, by J. Bland, L. J. Privoznik and F. J. Winsor, Standard Oil Co. of Indiana.

Effect of stresses and stress relief on the bursting strength of circumferentially welded cylinders, by L. J. Privoznik and F. J. Winsor, Standard Oil Co. of Indiana.

The ship structure sessions, prominent at the last several conventions of the American Welding Society, are omitted from this year's program. Instead there will be two sessions on marine construction. To judge by the titles of the papers, these sessions will be more on the practical and less on the theoretical and research side than the predecessor ship structure sessions.

David P. Brown, American Bureau of Shipping, is chairman of the first marine construction session, to be held on Thursday morning. A. A. Holzbaur, Sun Shipbuilding & Dry Dock Co., is co-chairman. Papers are:

New rules for welding low-alloy ferritic pipe material, by Commander Charles F. Perry, U. S. Coast Guard.

Evaluation of brittle failure research, by Paul Ffield and Ed Sweeney, Bethlehem Steel Co.

An investigation on peening, by P. L. Calamari, F. J. Crum, G. W. Place, American Bureau of Shipping.

H. W. Pierce, New York Shipbuilding Corp., is chairman at the second session on Friday morning. J. Lyell Wilson, consulting naval architect, is co-chairman. Papers are:

Observations on experience with welded ships, by David P. Brown, American Bureau of Shipping.

Prevention of marine corrosion by metallizing systems, by Howard Vanderpool, Metallizing Engineering Co.

Failure and defects encountered in welded ship construction, by Ralph D. Bradway, New York Shipbuilding Corp.

Weldability

There are to be four sessions on the rather broad subject of "weldability," at which a total of 14 papers will be presented. These are the technical papers that are really technical.

R. E. Somers, of Bethlehem Steel Co., is chairman of the first weldability session on Tuesday morning. A. B. Gordon, Linde Air Products Co., is co-chairman. Papers are:

Further studies of the crack sensitivity of aircraft steels, by A. W.

Steinberger and J. Stoop, Curtiss-Wright Corp., Propeller Division.

Effect of geometry on stresses in circular patch specimen, by Alan V. Levy and Harry E. Kennedy, University of California.

Evaluation of the circular patch weld test, by John E. Hockett and L. O. Seaborn, University of California.

Relationship of welding technique to penetration and dilution, by Clarence E. Jackson and Arthur E. Shrubsall, Union Carbide and Carbon Research Laboratories.

E. M. MacCutcheon, Jr., Bureau of Ships, Navy Department, is chairman of the second weldability session on Tuesday afternoon. L. J. Larson, Allis-Chalmers Mfg. Co., is co-chairman. Papers are:

Effect of strain rate on twinning and brittle fracture in low-carbon steel, by D. Rosenthal and C. C. Woolsey, Jr., University of California.

Interpretation of test data regarding brittle strength and transition temperature of structural steel, by N. M. Newmark and W. C. Hoeltje, University of Illinois.

Factors affecting the resistance of pressure-vessel steels to repeated overloading, by Robert D. Stout, John H. Gross and Schillings Tsang, Lehigh University.

L. C. Bibber, of United States Steel Co., is chairman of the third weldability session on Wednesday morning. Captain R. H. Lambert, USN, is co-chairman. Papers continue to have long titles:

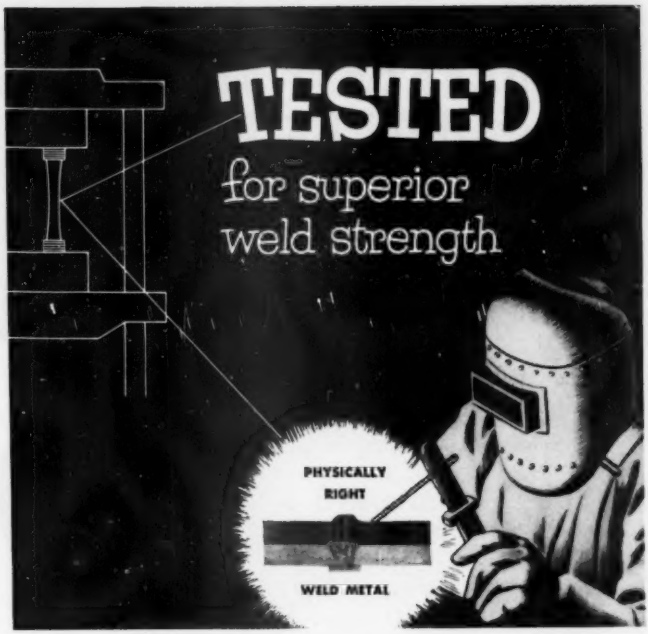
Relation of preheating to low-temperature cooling rate embrittlement and microcracking, by A. E. Flanigan and T. Micleu, University of California.

Initiation and propagation of brittle fracture in structural steels, by Peter P. Puzak, Earl W. Eschbacher and William S. Pellini, Naval Research Laboratory.

Continuous cooling transformation of weld heat-affected zones, by W. R. Apblett, Jr., L. K. Poole and W. S. Pellini, Naval Research Laboratory.

Determination of optimum conditions for the automatic welding of hardenable steels, by C. R. McKinsey and J. F. Collins, Union Carbide & Carbon Research Laboratories, Inc.

R. D. Thomas, Jr., Arcos Corp., is chairman of the fourth and final weldability session on Wednesday afternoon. C. B. Jenni, General Steel Castings Corp., is co-chairman. Papers are:



Use ARCOS Stainless Electrodes

Because Arcos applies a series of mechanical performance tests for strength, toughness, and ductility to all types of Stainless weld metal, you can be sure that your deposits with Arcos Stainless Electrodes will be physically "right". Whatever the job requirement—ability to withstand heavy loads, high pressures, or severe shocks—you'll get the results you want.

Other Arcos "quality controls" assure that the weld metal will be chemically and metallurgically "right" as well. That's why it will pay you to depend on Arcos Stainless Electrodes for the correct combination of properties that lead to sound welds on every job. ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Penna.

WELD WITH

ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

"THE GREATEST BRAZING SHOW ON EARTH"

NATIONAL METAL CONGRESS
PHILADELPHIA • BOOTH 110

INTERESTING! AMAZING! EDUCATIONAL!

3-ring exhibition of metal joining strength, speed and versatility by the world-renowned EASY-FLO and SIL-FOS low-temperature silver brazing alloys.

IN RING 1 →
Eye-opening demonstration of torch brazing ease and versatility. Also, surprising carbide tool tipping performance by a new member of the famous H&H brazing troupe—Trimetal.

CENTER RING→
EASY-FLO in a revealing exhibition of production brazing—turning out finished assemblies with the greatest of ease.

↑ IN RING 3
From the four corners of industry—four 2-minute movies of EASY-FLO and SIL-FOS in action.

BRAZING EXPERTS
always on hand to discuss your own brazing jobs and problems.

IF YOU DON'T GO TO THE SHOW

Ask us to send a field engineer to demonstrate the alloys in your plant. Or get the facts from our nearest distributor.

BULLETIN 20
will also give you the full EASY-FLO and SIL-FOS story. Write for a copy today.

85th Anniversary

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MONTREAL, CANADA

Embrittlement of high-strength ferritic welds, by Peter P. Puzak and William S. Pellini, Naval Research Laboratory.

Temper brittleness in low-alloy metal, by Richard P. Wentworth and Hallock C. Campbell, Arcos Corp.

Effects of electrodes and welding conditions on the ductility of arc-welded mild steels, by Ernest F. Nippes and Alexander Lesnewich, Rensselaer Polytechnic Institute.

Summing It All Up

On the whole, it appears to be an excellent convention program. Whether you are a long-hair or a practical shop man, you should find plenty to interest you. We are glad to see that more time is left open for the Metal Show and for extra-curricular convention activities. If you are coming there for work, however, the thirty-third AWS convention should be right down your alley.

A ROYAL WELCOME

(Continued from page 70)

Philadelphia the week of the Metal Show. These are: American Welding Society (Bellevue-Stratford Hotel); American Society for Metals (Hotel Benjamin Franklin); Institute of Metals Div., American Institute of Mining and Metallurgical Engineers (Hotel Adelphia) and Society for Non-Destructive Testing (Hotel Sylvania).

The American Society for Metals will hold its annual seminar on the Saturday and Sunday preceding the Metal Show, Oct. 18-19. Subject of the 1952 ASM seminar is "Modern Research Techniques in Physical Metallurgy."

Metallographic Exhibit

ASM will also hold its seventh metallographic exhibit during the week of the Metal Show. A large area has been reserved within the Philadelphia Convention Halls so that displays can be shown to best advantage.

Ten classifications of "micros" are designated for the contest: (1) tool steels and tool alloys; (2) stainless and heat-resisting steels; (3) other steels and irons; (4) aluminum, magnesium, beryllium, titanium and their alloys; (5) copper, zinc, lead, nickel and their alloys; (6) metals

and alloys not otherwise classified; (7) series showing transitions or changes during processing; (8) surface phenomena; (9) results by unconventional techniques (other than electron micrographs); (10) slags, oxides and inclusions.

A committee of judges will award a first prize (blue ribbon) to the best entry in each classification. Honorable mention will be awarded to those approaching the winners. Work that has appeared at previous ASM metallographic exhibits is not eligible for either display or prizes.

A grand prize (engrossed certificate and $100 cash) will be presented to the exhibitor whose entry is adjudged best in the show. The grand prize entry becomes the property of the American Society for Metals and will be displayed permanently in the Society's national headquarters.

The 1952 metallographic exhibit will also include a competition for undergraduate students. First prize is a bronze medal and $25 cash; honorable mention, a ribbon and $10 cash.

Throughout the week, the American Welding Society and the American Society for Metals will hold morning, afternoon and evening meetings. The Institute of Metals Division, AIME, will hold daily and evening technical sessions Monday through Wednesday. The Society for Non-Destructive Testing will hold sessions during four days of the week.

New Inspection Methods

Progress in the field of non-destructive testing has been amazing. Some of the topics listed for discussion in the Society's annual program read like the pages of a science-fiction magazine. Here are a few of the new developments.

Industrial betatron.

Polaroid process for one-minute radiography.

Micro-radiography.

Fluorescent X-rays.

Radiography with iridium 192.

Immersion ultrasonic testing techniques.

Geophysics as related to non-destructive testing.

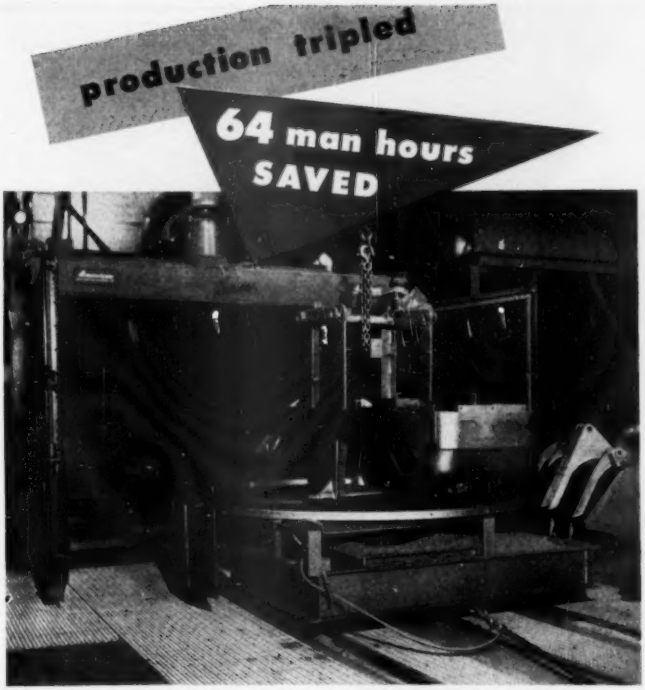
Search coil flaw detection.

Metal comparator.

Liquid penetrant inspection.

Wire-resistant strain gages.

Measurement of ionization in dielectric structures.



cleaning weldments for Frank G. Hough Company with a

WHEELABRATOR

Welding spatter and flux is removed in minutes by the airless Wheelabrator to save hours of wire brushing, grinding and chiseling. Welded areas are spotlessly cleaned to provide a perfect anchor for bonding the final finish.

For the Frank G. Hough Co., where two full shifts and 14 men had been unable to maintain existing schedules by wire brushing, chipping and grinding, the Wheelabrator handles the vastly expanded production at a savings of 64 man hours daily. Finishing operations have been placed on a production of dollars in production costs. In addition, the thoroughness of Wheelabrator cleaning provides a uniform surface to which paint adheres tenaciously.

The use of the Wheelabrator in the welding industry is described in the bulletin, "How Weldments are cleaned faster and cheaper with a Wheelabrator." Airmail your request for a free copy today.

American Wheelabrator AIRLESS BLAST CLEANING

WHEELABRATOR & EQUIPMENT CORP.

857 S. Byrkit St., Mishawaka, Ind.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST CLEANING EQUIPMENT

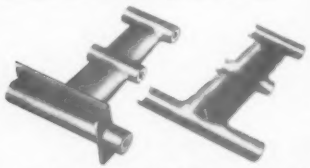
A jet turbine stator section fabricated of cobalt base alloy and AISI 310 stainless steel, brazed with NICROBRAZ.

NICROBRAZ

New corrosion resistant alloy brazes stainless steel for 2000° F. service

COLMONOY NICROBRAZ is a heat and corrosion resistant nickel-chrome alloy, developed primarily for brazing stainless steels and special alloys. It has these highly desirable qualities:

NICROBRAZ resists high heat. A NICROBRAZ joint in a stainless steel assembly has a tensile strength equal to that of the parent metal while the assembly is operating at 2000° F. This quality ranks NICROBRAZ above any other known material for brazing parts for service in the high temperatures of modern aeronautical power plants.



Previously cast, this fuel injection nozzle support assembly is now stamped (right) of S 590 stainless alloy and then brazed (left) with NICROBRAZ.

Heat exchanger is made up of five corrugated and six flat sheets of 316 stainless steel, .010" thick. Brazed with NICROBRAZ in one operation.

Mercury bulb and tube assembly. Tube is .032" stainless steel with .006" I.D. hole. Five joints brazed in one operation with NICROBRAZ.

NICROBRAZ resists oxidation and corrosion. It is extremely resistant to the action of most chemicals and retains its physical properties under oxidizing conditions. Previously, for lack of a corrosion resistant brazing alloy, many stainless steel assemblies have been machined from the solid, or welded or assembled by mechanical means. With NICROBRAZ they'll be made more easily and at less cost. NICROBRAZ will change design thinking in many industries, such as: *aeronautical, automotive, food, dairy, pharmaceutical, nuclear energy, control instruments, chemical, and oil refining*

NICROBRAZ is available as a powder or in strip and shim stock. It flows readily at 2100° F. in a pure dry hydrogen atmosphere, and will penetrate a contact joint by capillary action. When brazing stainless steels, a stable new alloy is formed by the NICROBRAZ alloying with the parent metal. Its ductility, strength, and corrosion resistance is then about the same as that of the parent metal and it has a much higher melting point then the original NICROBRAZ.

Wall Colmonoy Corporation maintains a plant at Detroit with the equipment necessary for the development and production of stainless steel joining operations utilizing NICROBRAZ. Bright annealing, bright hardening, complete heat treating, and the brazing of stainless steel and other alloys can also be processed in our plant.

For more information contact Wall Colmonoy Corporation, 19345 John R Street, Detroit 3, Michigan.

Branches; Long Island City, Buffalo, Chicago, Houston, Los Angeles, Montreal.

WALL COLMONOY
CORPORATION
HARD FACING ALLOYS
19345 JOHN R STREET DETROIT 3, MICHIGAN

Here are some names culled from the 1952 list of exhibitors. If we have omitted anyone who should have been included, our profound apologies.

List of Exhibitors

Acetogen Fabricators, Inc., Philadelphia; Air Reduction Sales Co., New York; Allegheny Ludlum Steel Corp., Brackenridge, Pa.; Alloy Rods Co., York, Pa.; Alpha Metals, Inc., Jersey City, N. J.; American Brake Shoe Co., American Mang. Steel Div., New York; American Brass Co., The, Waterbury, Conn.; American Chain & Cable Co., Inc., Bridgeport; American Optical Co., Instrument Div., Buffalo, N. Y., American Platinum Works, The, Newark, N. J., American Silver Co., Inc., Flushing, N. Y.; American Wheelabrator & Equip. Corp., Mishawaka, Ind.; Ampco Metal, Inc., Milwaukee; Arcair Co., Bremerton, Wash.; Arcos Corp., Philadelphia; Aronson Machine Co., Arcade, N. Y.; Acme Mfg. Co., Detroit (Ferndale), Mich.; American Pullmax Co., Inc., Chicago.

Babcock & Wilcox Co., Beaver Falls, Pa.; Bausch & Lomb Optical Co., Rochester, N. Y; Beryllium Corp., The, Reading Pa.; Bridgeport Brass Co., Bridgeport, Conn.; Brush Development Co., Instrument Div., Cleveland.

Challenge Machinery Co., The, Grand Haven, Mich.; Chase Brass & Copper Co., Waterbury, Conn.; Chicago Tool & Engineering Co., Chicago; Carpenter Steel Co., Reading, Pa.; Clinton Machine Co., Warner Div., Detroit; Crucible Steel Co. of America, Pittsburgh.

Diversey Corp., The, Chicago; Dow Chemical Co., Midland, Mich.; Diamond Iron Works, Mahr Mfg. Co. Div., Minneapolis.

Empire Products, Inc., Cam-Lok Div., Cincinnati; Erico Products, Inc., Cleveland; Eutectic Welding Alloys Corp., Flushing, N. Y.

Fostoria Pressed Steel Corp., The, Fostoria, O.

General Electric Co., Apparatus Sales Div., Schenectady, N. Y.; General Electric Co., Milwaukee; Graham Manufacturing Corp., Ferndale, Mich.; Gregory Industries, Inc., Nelson Stud Welding Div., Lorain, O.

Hammond Machinery Builders, Inc., Kalamazoo, Mich.; Handy & Harman, New York; Harnischfeger Corp., Milwaukee; Heath Engineering Co., Fort Collins, Colo.

International Nickel Co., Inc., New York; Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio.

K S M Products, Inc., Merchantville, N. J.; Kelite Products, Inc., Los Angeles; Kelley-Koett X-Ray Corp., Covington, Ky.

Lepel High Frequency Labs., Inc., New York; Lincoln Electric Co., Cleveland; Linde Air Products Co., New York.

Magnaflux Corp., Chicago; Makepeace Co., D. E., Attleboro, Mass.; Mall Tool Co., Chicago; Mallory & Co., Inc., P. R., Indianapolis; McGraw-Hill Publishing Co., Inc., New York; Metal & Thermit Corp., New York; Metalweld, Inc., Philadelphia; Miller Electric Mfg. Co., Appleton, Wis.; Mid West Abrasive Co., Owosso, Mich..

National Cylinder Gas Co., Chicago; National Lead Co., New York; National Torch Tip Co., Pittsburgh; National Welding Supply Assoc., Philadelphia; North American Philips Co., Inc., Mt. Vermon, N. Y.

Oakite Products, Inc., New York; Ohio Crankshaft Co., Tocco Div., Cleveland; O'Neil-Irwin Mfg. Co., Lake City, Minn.; Osborn Mfg. Co., Cleveland.

Pangborn Corp., Hagerstown, Md.; Phillips Mfg. Co., Inc., Chicago; Picker X-Ray Corp., White Plains, N. Y.; Precision Welder & Machine Co., Cincinnati; Progressive Welder Sales Co., Detroit.

Radio Corp. of America, RCA Victor Div., Camden, N. J.; Raytheon Manufacturing Co., Waltham, Mass.; Reynolds Metals Co., Louisville, Ky.; Ryerson & Son, Inc., Joseph T., Chicago.

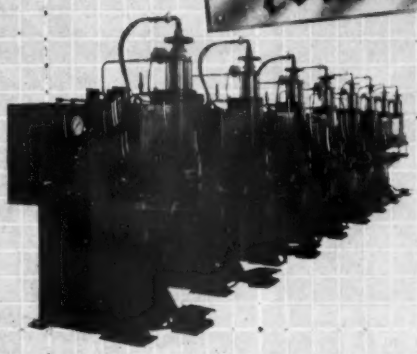
Sciaky Bros., Inc., Chicago; Smith Welding Equipment Corp., Minneapolis; A. O. Smith Corp., Milwaukee; Sperry Products, Inc., Danbury, Conn.

Tempil Corp., New York; Titanium Alloy Mfg. Div., National Lead Co., New York; Titanium Metals Corp. of America, New York; Turco Products, Inc., Los Angeles.

Union Carbide & Carbon Corp., Haynes Stellite Div., Kokomo, Ind.; Union Carbide & Carbon Corp., New York; Union Carbide & Carbon Corp., National Carbon Div., New York.

Wall Colmonoy Corp., Detroit; Weldwire Co., Inc., Philadelphia; Westinghouse Electric Corp., Pittsburgh; Whitehead Metal Products Co., Inc., New York; Worthington Corp., Plainfield, N. J.

STAINLESS EXPERTS CHOOSE Federal



SINGLE PHASE *for* PRODUCTION LINE WELDING . . .

If you're welding stainless steel or alloys such as Nimonic and want the lowest cost and most efficient methods possible, get the Federal story before you buy your first piece of equipment.

The welders pictured on this page are part of a shipment to a nationally known stainless steel fabricator* who has worked with Federal engineers in making exhaustive studies on the subject. The welders are of the Federal Press Type Single Phase design that have been in constant use by this company for many years.

One of the nation's largest builders of resistance welders of all types — single phase or three phase — Federal will help you get the exact welder you need to do the best job. Contact your nearest Federal representative or write direct.

*Name on request.

Federal® WELDERS

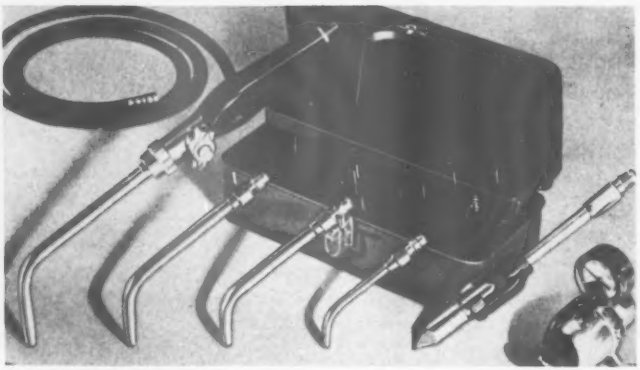
Varco® PRESSES

THE FEDERAL MACHINE & WELDER CO.

WARREN, OHIO

New Products . . .

GOOD ROOT beads are easier when special tape holds in all the flux



INTERCHANGEABLE torch tips and soldering iron recommend a new air-acetylene heating outfit. Torch has special handle and regulator is also new

Glass Tape Aids Welding

251 NEW pressure-sensitive tapes, "Scotch" brand, are used to hold the flux in place on submerged-arc welding jobs. The tape holds the flux until the stringer bead for the weld joint is completed. The tape has been tested on weld joints ranging between ¼ and 3-in. thick.

Applied to the underside of weld joints, the tape burns off when the metal reaches a red heat. For welding operations using up to 700 amp heat, No. 710 tape (acetate backed) performs well; for welds requiring 900 amp heat, the No. 365 tape (glass cloth backed) is used. This method has been extensively used at Farrar & Trefts, Inc., Buffalo, N. Y., says the manufacturer.

MINNESOTA MINING AND MFG. CO., St. Paul 6, Minn.

5-in-1 Torch Kit

252 FULL capacities of five separate outfits for soldering, heating and light brazing are combined in one new "Prest-O-Lite" outfit. Jobs within the range of the kit include delicate soldering in television work to heating frozen pipes.

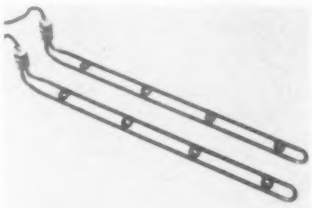
Four interchangeable torch tips and a pointed copper soldering iron fit a precision control handle that equipped with a pilot needle valve in the shutoff valve. This needle valve can be adjusted to keep only a small pilot flame burning on an intermittent work schedule. A one-quarter turn of the valve operates it.

An acetylene pressure regulator of the newest design is included in the outfit. It delivers acetylene at any pressure up to 13 psi as long as usable pressure remains in the tank. Hose with standard "A" size (left hand thread) fittings and a metal carrying case complete the outfit.

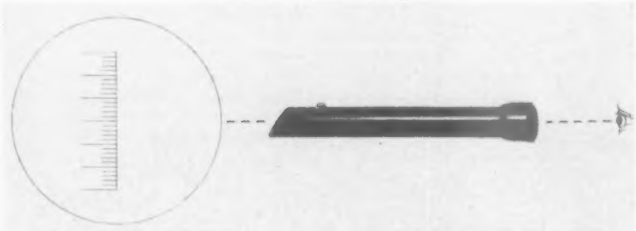
A 4-in-1 outfit also is being produced in the "Prest-O-Lite" line which covers the same range of work as the larger kit except for soldering jobs where an iron is needed.

LINDE AIR PRODUCTS CO., New York City 17.

* * *



Pocket Microscope



253 FOR quick checks on the size of blowholes or cracks in welds, the "Optometer" pocket measuring-microscope has many advantages. An engraved scale mounted in the body tube reads directly to 0.002 in. and estimations can be made easily to 0.0005 in. The tool is about the size of a fountain pen and fits a shirt pocket.

NATIONAL INSTRUMENT CO., Baltimore 15, Md.

Tubular Weld Preheater

254 NEWEST heating aid for welding steel pipe and plate is Chromalox electric tubular heater available in special shapes to fit almost any weld contour. The heaters are placed between the weld line and larger sections of cold metal to form "heat dams" that slow conduction of heat away from the weld. On straight line welds, the heaters are held in place about 6 in. from the joint by bolting them to tack-welded studs.

The heaters will build up a 400-500 F preheat in the weld zone before welding begins. If left on after the joint is completed, they provide any type of postheat cycle required also.

EDWIN L. WIEGAND CO., Pittsburgh 8.

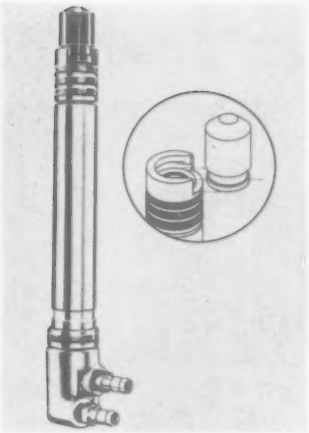
New... A-C WELDER for Armor Welding

80-VOLT UNIT BRINGS BETTER ARMOR WELDING WITH LOW HYDROGEN ELECTRODES

In answer to the increased demands of the armament program, Westinghouse has developed an 80-volt machine to obtain better quality welds with low hydrogen electrodes. The new 400- and 500-ampere, 80-volt units supplement the proven 65-volt line. They are equipped with built-in voltage reducing controls.

Primary capacitors are included for raising the primary power factor to approximately 80% at rated load. Units are designed to automatically disconnect all but one of their capacitors during idling. The remaining capacitor furnishes the excitation kva of the transformer. A built-in, 2-pole, F-frame breaker serves as a disconnect switch.

For further information on these new 400- and 500-ampere ratings or on other Westinghouse welding equipment, write Westinghouse Electric Corporation, Welding Division, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21612



6,000 Lb R-W Holders

255 An entirely new approach to heavy-duty electrode-holder construction has produced the Mallory "Nu-Twist" line for spot welding forces over 6,000 lb. The new design includes flat mating surfaces between holder and electrode to eliminate threaded and tapered connections. Flat surfaces will support the highest welding pressure, yet can be quickly removed by hand. They are silver-plated for low contact resistance.

No tools are needed to work the hand-operated electrode locking nut. A special double-grooved construction in the bore of the locking nut positively aligns electrode centrally in the holder and locks it in position.

An O-ring seal provides water-tight connections. The coolant hole and wall thickness of the electrodes are proportioned to insure efficient cooling with enough metal section to carry the higher welding currents without overheating. The retractable coolant head permits retracting the adjustable coolant tube when removing or installing electrodes. The tube locks automatically into normal position when the head is in operating position.

The Mallory "Nu-Twist" holders are available from stock in 8 and 12-in. lengths and in 1½, 1¾, 2 and 2½ in. barrel diameters. Electrodes are available from stock in Elkaloy A, Mallory 3 and Mallory 100 metal.

P. R. Mallory & Co., Indianapolis 6, Ind.

* * *

Heavier Aluminum Etch

256 Composition No. 60 is a new Oakite material designed to produce a heavier, more uniform etch on aluminum. It is said to etch rapidly, giving a controlled etch of any depth desire, eliminates hard scale build-up on tanks and heating coils and provides consistent etching without excessive foaming or fuming. Etched parts will rinse readily in cold or hot water, says Oakite.

Oakite Products, Inc., New York City 6.

* * *

New Bonding Agent

257 A unique new bonding agent, "ChemoTec," will efficiently join aluminum, manganese, titanium and other metals at low heats of 250 to 300 F, says the maker. Metals can also be joined to ceramics, glass or wood by the new agent which is available in rod, powder, paste and liquid forms.

In rod form it is applied as in welding, except that the heat required is much lower. Maximum strength is obtained in close fitting joints (clearance of from 0.004 to 0.008 in.).

It bonds by capillary and chemical action, the latter being produced by the application of the low heat. President of the company producing this material in the United States says that it is the first bonding agent to cover the lower heat ranges without the disadvantages of soldering fluxes, special irons, etc. In addition, "ChemoTec" is not confined to any particular production technique.

ChemoTec Division, Flushing New York City.

* * *

Air-Operated Hoist

258 As much as 1,000 lb can be lifted by a Keller air hoist weighing only 30 lb. Maker points out they can't burn out from stalling and are virtually unaffected by dust and fume-laden air. In addition safety hooks are now standard for the load hook and optional for the suspension hook. Improvements have been made in the lubrication system, brakes, bearings, control lever, ring gears, pendent controls and special accessories available.

Keller Tool Co., Grand Haven, Mich.

INFO-AID CARDS
on pages 17-18, filled out with item numbers of products catching your eye, will bring you additional information about them.

Acetylene Regulator

259 The R-411 acetylene regulator is designed for small-tank apparatus such as the soldering outfits carried by plumbers and refrigerator repairmen. However, it is said to have ample capacity for the most efficient use of any air-acetylene torch or appliance. Acetylene can be delivered at pressures up to 13 psi. Pressure gage shows tank contents on a dial calibrated at ¼, ½, ¾ and full, like the dial of an automobile gasoline tank gage.

Linde Air Products Co., New York 17, N. Y.

* * *

1,000 Amp Welder

260 A new British transformer-type welder for supplying automatic welding heads is rated at 1,000 amp, 80 kva. Called "Thermac" it is a moving-coil, single-phase design, suitable for stepping down the supply voltage from 440 to 80.

Oil-cooled, it has a number of tubes encircling the coils for carrying the oil. A hand regulator controls the effective reactance.

Metrovick also has a new spot welder, the AS60/24, that is air-operated and automatic after preliminary setting up of controls. Two timers, one a thyratron, control the welding and forging times, and may be adjusted for the particular work being done. Using 80 psi line pressure, welding pressures of 1,000 psi can be obtained. The standard machine is available with a 24-in throat depth. Welding capacity is two pieces of 3/16-in. mild steel plate.

Metropolitan Vickers Electrical Co., Ltd., Manchester 17, England.

(More Products on Page 120)

UNIVERSALLY ACCEPTED

HYPODERMIC needle-gage tells if grinders get correct air pressure. If not, money is lost (see below)

100-TON floating crane on all-welded hull undergoes exhaustive tests at Pittsburgh shipyard of Dravo Corp.

NEWS

Eighth Western Congress Scheduled for March, 1953

NEXT March, Los Angeles will be the headquarters for the eighth Western Metal Congress and Western Metal Exposition sponsored by the American Society for Metals. There will be five days of technical sessions on subjects pertaining to the making, working, fabricating, treating, welding, inspection and use of metals.

Hotel headquarters and conference-meeting-place will be the new Hotel Statler. The meeting date is March 23-27, 1953.

* * *

Steel Industry Back to 98.7% Capacity

OPERATING rate of the steel industry stood at 98.7% capacity for the week beginning August 25, 1952, according to American Iron and Steel Institute. This announcement, the fifth since the end of the steel strike, was based on reports from companies having 93% of the industry's steel capacity.

The 98.7% rate is equivalent to the production of 2,050,000 tons of steel ingots and castings for the entire industry. This compares to actual production of 2,017,000 tons a week earlier when operating rate was 97.1% capacity, and to actual production of 891,000 tons a month earlier.

* * *

Power Show Planned for December in New York

TECHNICAL advances in power plants will be under review at the 20th National Exposition of Power and Mechanical Engineering during the first week of December in New York.

The Power Show, sponsored by the American Society of Mechanical Engineers, will include many exhibits of scientific interest and advanced technology. Examples are uses of the electron microscope and the adaptation of television to industrial jobs.

* * *

Leaking Air Lines Cause Production Losses

PRODUCTION output of an air-operated tool may drop as much as 35% if the air line pressure falls from 90 psig to 70 psig. So warns the Compressed Air and Gas Institute at Cleveland. Reasonable maintenance of an air system will always prevent a loss in production and dollars, claims the institute.

Another source of lost production can be traced to air motors operating on less than designed air pressure. Because compressed air systems in most plants utilizes pressures between 90 and 110 psig, air motors are designed to operate within those working pressures. An air motor, built to operate at 90 psig, however, will lose 25% of its capacity if line losses in delivering air drop the pressure to 70 psig.

First inclination when air pressures drop may be to place the blame on insufficient compressor capacity. A check of the air distribution system, first, may save the cost of new compressor equipment.

Inspecting the air distribution system for leaks is a relatively simple matter. Results have proved that the most likely location of small leaks are around valve stems, hose connections, unions, drains, home-made blow guns, and lines leading to inoperative tools. Of course, the entire system should be checked with particular attention to the above and to lines which are subjected to unusually rugged treatment. Inspections should be made every month.

Plant maintenance departments have come up with many simple and unique ways to check leaks. Most frequently used are the lighted candle or the solution of soapy water which is brushed around suspected areas. One manufacturer puts essence of peppermint into the air system. The characteristic odor will show up at the slightest leak. Other plants have used a small siren-like whistle, activated by air flow, which is passed over the lines. As soon as leaks are located, they should be patched on the spot.

Some leaks may be very small, appearing trivial in themselves. Actually they can mean a definite dollar loss. A $\frac{3}{8}$-in. opening in an air line will waste 6,671,890 cu ft of 100 psig air per month at a cost of $467.03, based on $.07 per 1,000 cu ft.

Comprehensive Handbook

THE WELDING OF MILD STEELS
MILD STEEL, LOW ALLOY & SPECIAL PURPOSE ELECTRODES
Published by Electrode Division
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THE McKAY COMPANY

Meet Government Specifications With
NEW SINGLE PHASE NON-SYNCHRONOUS
UP-DOWN SLOPE CONTROL
with
Robotron "CUSHIONED POWER" WELDING TIMERS

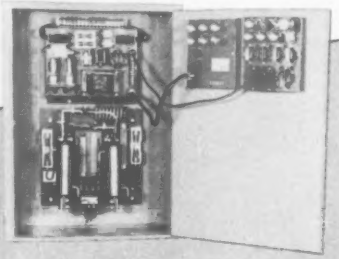
Now . . . with this new concept of Non-Synchronous SINGLE PHASE Control you can weld all types of Brass, Aluminum, Monel Metal, Stainless and Nickel Alloy Steels, Coated or Plated Metals or any combination of Dissimilar Metals and meet U. S. Government Specifications. Welding is accomplished with minimum surface indentation, and electrode pick-up, maximum ductility and constant uniformity. The Robotron Non-Synchronous SINGLE PHASE Control Unit has the simplicity of a single phase circuit instead of the present complicated and difficult-to-maintain multiple circuits.

HI-CONDUCTIVITY
LO-CONDUCTIVITY

Robotron's "Cushioned-Power" welding cycle begins with a PREHEAT, or up slope, stage that assures proper seating of electrodes, cutting down surface resistance and increasing WELD heat where it's needed. It also decreases surface indentation, spewing of metal and lengthens the life of the electrodes. The TEMPER stage, or down slope (Trailing Current), controls rate of heat flow into the surrounding metal after weld is over, definitely controlling brittleness and in case of Coated Metals, allows coating or plating to resurface the weld.

Non-Synchronous "UP-DOWN" Slope Welding Control Unit is the least expensive unit on the market today, and it still assures better welds under a greater variety of welding conditions.

And best of all . . . Robotron's well-known plug-in feature gives you quick, easy installation and maintenance, plus complete versatility and adaptability in operation.



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NEMA 3B WITH "UP-DOWN" SLOPE CONTROL —600 AMP. IGNITRON CONTACTOR AND SIZE "B" IGNITRON TUBES

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Ask about our on-the-job approval plan. (NO OBLIGATION)

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3803 *T. M. Registered

Alloy Rods Produces New Color Movie

INSIDE story on how arc-welding electrodes are manufactured is revealed in a new full-color sound film recently produced for the Alloy Rods Co., York, Pa. The picture, which takes 22 minutes to see, starts from the initial step of cold drawing of the hot-rolled rod and continues through many manufacturing, research, and quality-control processes to the packing of the finished electrodes in containers. The viewer is taken via the camera right up beside production workers and lab technicians. A narrator interprets close-ups in readily understandable terms.

According to company officials, this film is not a promotional device but was photographed to be an instructional and technical pictorial story. It is intended mainly for showings at welding society meetings and other engineering groups, metalworking industry organizations, college and university classes, etc. 16-mm prints will be made available for such showings.

* * *

Engineers Celebrate Centennial in Chicago

ENGINEERS from all over the world were given opportunity to inspect the latest important technical installations in the Chicago area when they attended the 11-day Centennial of Engineering that started Sept. 3.

Among projects inspected were the new 96-acre Ridgeland plant of the Commonwealth Edison Co.; the West-Southwest sewage works of the Sanitary District; the Indiana Harbor Works of the Inland Steel Co., which produces 4,500,000 ingot-tons per year; and the new research and development laboratories of the Portland Cement Association of Skokie, Ill.

The big climax of the Centennial was an all-day meeting on national defense. More than 2,500 Army, Navy, and Air Force engineers met Sept. 13 at the Conrad Hilton hotel for technical sessions on engineering problems in the Arctic, Europe and Korea. The defense day included a Navy-sponsored luncheon and a "Military Engineer" dinner, both in the Hilton's grand ballroom.

* * *

Philippines Buy Torches

THE Bureau of Public Roads(Washington, D. C., has asked for bids on ten welding and cutting torches for the Phillipine Highway Construction Program. Earlier this year, the same program in the Phillipines prompted bids on engine-driven arc welders, says the Office of Small Business, Mutual Security Agency.

1 **BONDERIZED STEEL FRAMES,** braze welded with ANACONDA-997 Bronze Rod, make the famous "Rusco" metal combination screen and storm sash. Foreman Jack Hollister points out brazed frame corner.

Production Story:

1,000,000 windows a year

Ingenuity, modern techniques, and good welding rod help F. C. Russell Co. braze weld 100 metal windows an hour.

2 **GOOD-FLOWING BRONZE ROD,** such as ANACONDA-997, is needed to run the braze metal into a groove .300" deep to hold screening in place. Each corner is brazed and the fillet is run right up to the edge of the section.

3 **SPECIAL WELDING FIXTURES,** shown in close-up, developed by "Rusco" engineers, facilitate rapid brazing of their windows. So does ANACONDA-997 Bronze Rod. It "fins" readily. The work stays clean, is easily finished.

4 **LOW FUMING CHARACTERISTICS** of ANACONDA-997 Bronze Rod allow welders like John Jenkins to work in comfort full time. Here he brazes handles on screen inserts for the windows. Weld quality comes first; speed next.

F. C. Russell Co., Cleveland, Ohio is a large multi-plant organization turning out more than a million metal windows a year. Production efficiency is boosted with ANACONDA-997 (Low Fuming) Bronze Welding Rod.

ANACONDA-997 Welding Rod is widely used for joining copper alloys, cast iron, malleable iron, steel and nickel alloys by oxyacetylene braze welding. It is ideal for repair-welding all types of industrial machinery and equipment. It is also used to deposit bearing surfaces.

Perhaps the Russell "*success story*" can be applied to your business. Whether your production is large or small, there is likely to be an ANACONDA Welding Rod for your purpose. They are sold by distributors throughout the United States.

For full information about ANACONDA Welding Rods and the latest welding techniques, write for Publication B-13. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

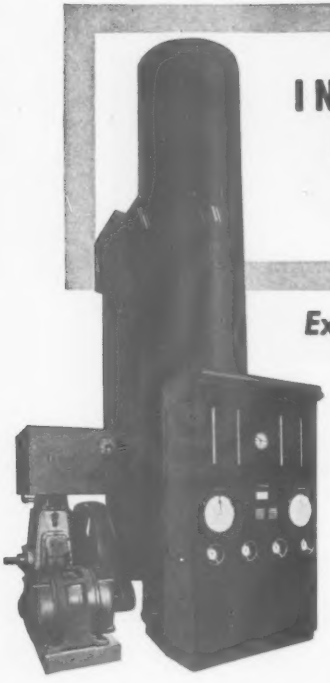
SEL 76

braze or weld with confidence

ANACONDA®

welding rods

ANACONDA



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Built in standard sizes—15 meters or 530 cu. ft to 283 meters or 10,000 cu. ft.—in single and double rectification units. If you need them, larger sizes are available.

If the more than one quarter of a million INDEPENDENT CYLINDERS we have built were filled at one time, they would hold more than 50,000,000 cu. ft. of gas!

Furthermore, Independent Acetylene Cylinders hold from 5 to 10% more gas, and the uniformity of the monolithic filler insures even distribution of acetone. Oxygen Storage cylinders available in 12' and 20' lengths; capacities 850 and 1500 cu. ft.

10 C.F. 40 C.F. 60 C.F. 100 C.F. 150 C.F. 250 C.F. 300 C.F. 340 C.F.

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O'FALLON 5, ILLINOIS

Long-Range Alaska Project to Bring in More Aluminum

ALUMINUM Company of America will construct a $400,000,000 aluminum smelting project in Alaska as soon as the necessary land is purchased and government approvals obtained. Initial production capacity is estimated at 200,000 tons of aluminum annually.

The smelting facilities and electric power developments necessary to operate them will be situated in the Taiya Valley district near Skagway, Alaska. Hydroelectric power for the project will be generated by damming the Yukon River at a site near Whitehorse. The project will take four years for completion.

A revision of the present land laws affecting Alaska will be necessary before ALCOA may acquire the 20,000 acres of land required to accommodate the proposed works, according to Leon E. Hickman, vice-president and general counsel for ALCOA. Financing of the project would be done entirely with private capital, without governmental guarantees of markets and with a minimum of governmental contractual assistance. However, it will probably be necessary to ask Congress to enact a law that will permit the company to purchase the necessary land.

* * *

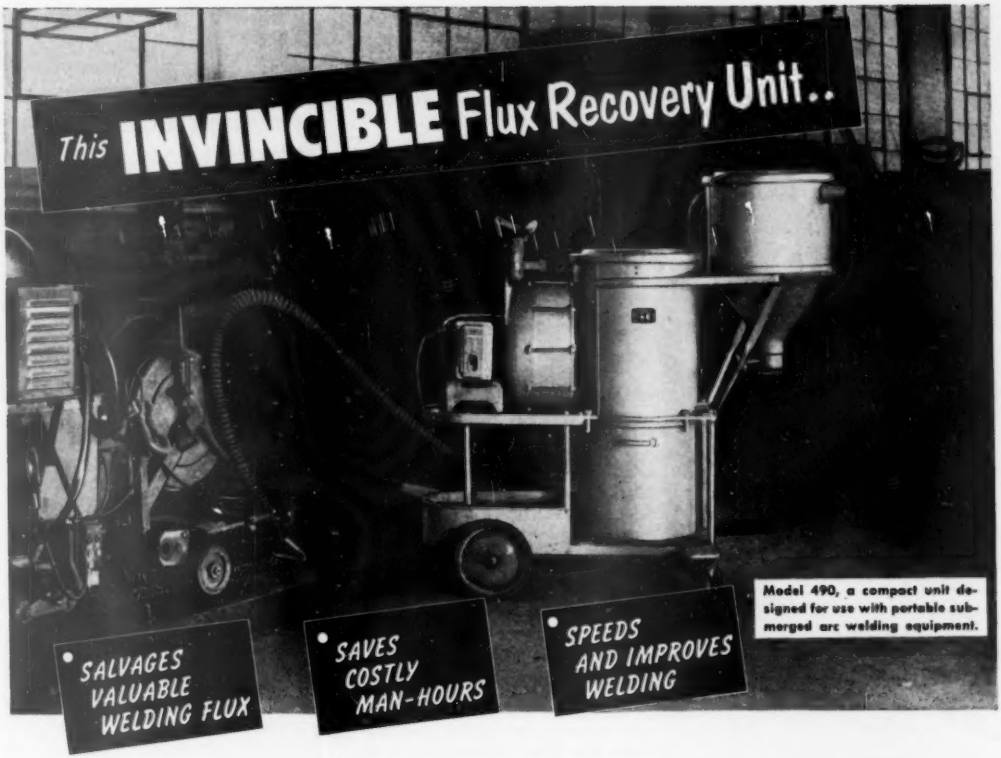
Fansteel Contracts for Columbian Production

A five-year contract to expand production of columbium and tantalum was recently negotiated by the Defense Materials Procurement Agency with the Fansteel Metallurgical Corp., North Chicago, Ill. The company has agreed to spend an estimated $455,280 of its own money in order to expand plant facilities. This will double its output of potassium tantalum fluoride, the basis of tantalum metal. In addition, Fansteel will recover columbium oxide from low-grade ores and residues.

The government will guarantee a market for that portion of the production which is not required immediately for defense purposes.

Columbium is an alloying element used in producting super-alloy steels requiring high-temperature resistance. It is especially adapted to jet aircraft engines. Tantalum, the sister element to columbium, is of particular use in the manufacture of electronic devices.

The United States is largely dependent upon foreign sources for its supply of columbium and tantalum minerals, chiefly Nigreia and the Belgian Congo.


This INVINCIBLE Flux Recovery Unit..
Model 490, a compact unit designed for use with portable submerged arc welding equipment.
• SALVAGES VALUABLE WELDING FLUX
• SAVES COSTLY MAN-HOURS
• SPEEDS AND IMPROVES WELDING

Our Invincible gives "very good results" is the report from The Rud Machine Co. of Cleveland. They use it extensively when repairing ships that carry freight over the Great Lakes. During winter months when the freighters are in port, Rud operates the unit almost every day.

On all sorts of submerged arc welding, hundreds of Invincible Flux Recovery Units are paying for themselves by:

1. SAVING VALUABLE FLUX—
Invincibles recover all loose flux from the work, remove slag or fused particles, and return the unfused flux to the hopper of the welder. These operations are performed in a continuous flow.

See Invincibles at Booth 1256, National Metal Exposition

2. SAVING COSTLY MAN-HOURS—
Invincibles do the job *automatically*—far more rapidly and efficiently than manual methods.

3. SAVING EXPENSE OF REJECTS—
By removing all fine dust (flux flour), Invincibles reduce welding rejects and speed production.

These savings can be made on any job because there is a size and type of Invincible Flux Recovery Unit to meet every requirement.

FREE FOLDER

on Flux Recovery. Illustrated case histories show how Invincibles save money on all kinds of installations. Send for your copy NOW!

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO
FOR 40 YEARS, LEADERS IN INDUSTRIAL VACUUM EQUIPMENT

. . . an all-position phosphor-bronze electrode that's easy to handle.

Phos-Trode is ideally suited for overlay work and for general maintenance and repair welding throughout industry.

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3. **High deposition rate** — Low spatter loss permits high welding currents for faster welding and lower costs.

4. **Sound deposits, high physicals** — Special ingredients in Phos-Trode coating give properly deoxidized deposits, sound welds and correct bead contour.

Phos-Trode, the most versatile electrode in the phosphor-bronze field, is available in 6 sizes from 3/32" to 1/4". Order your supply now and take advantage of Phos-Trode's 4-way savings.

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Engineers Wasted by Industry's Inertia

A NATIONWIDE survey reveals that an estimated 60% of the potential managerial talent of engineers is being lost due to poor communications between engineers and top management. These facts are pointed out by the National Society of Professional Engineers after their six months' research into 350 industrial companies employing some 50,000 engineers.

The study showed that 99% of the 359 firms surveyed had engineers in top executive positions, yet only 34% had any planned program of indoctrination to prepare engineers for leadership. Although the majority of companies want opinions and suggestions from their engineers, there is little participation.

The 48-page survey report entitled "How to Improve Engineering-Management Communications" may be obtained from the National Society of Professional Engineers, 1121 15th St. N.S., Washington 5, D.C.

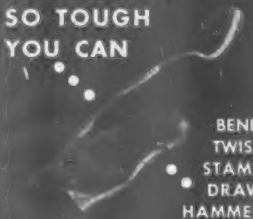
The survey is an initial attempt to help industry alleviate the current shortage of engineers by full use of its present engineering force. It provides information on current practices and recommendations on improved practices. The report is based on answers of company top management from questionnaires, and interviews. The Chief Engineers is the key engineering executive for he controls communication in both directions. The largest companies, and the smallest companies do the best job of communicating with their engineers. It is the medium-sized organizations (whom employ the majority of engineers) that lack the close interrelationship necessary.

* * *

"He handles eight holders at once and never complains about overtime!"

Low Temperature **BRAZING** will help you cut your metal JOINING COSTS

BRAZED AND SO TOUGH YOU CAN



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HAMMER IT
and it won't break or leak under pressure

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For better brazing

For the STEELS IRON NICKELS
SIL-BOND
45% Silver Alloy ... Low cost general purpose alloy. Melts 1320°F brazes 1145°F. Use with Sil-FLUX. Tensile 70 000 p.s.i.

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6% Silver ... Low cost ... stronger than metals brazed. Melts 1185°F brazes 1130°F. Use with Sil-FLUX. Tensile 95 000 p.s.i.

For the COPPERS
PHOSCO
No Silver ... Very low cost ... stronger than metals brazed. Melts 1308°F brazes 1493°F. Self-fluxing. Tensile 85 000 p.s.i.

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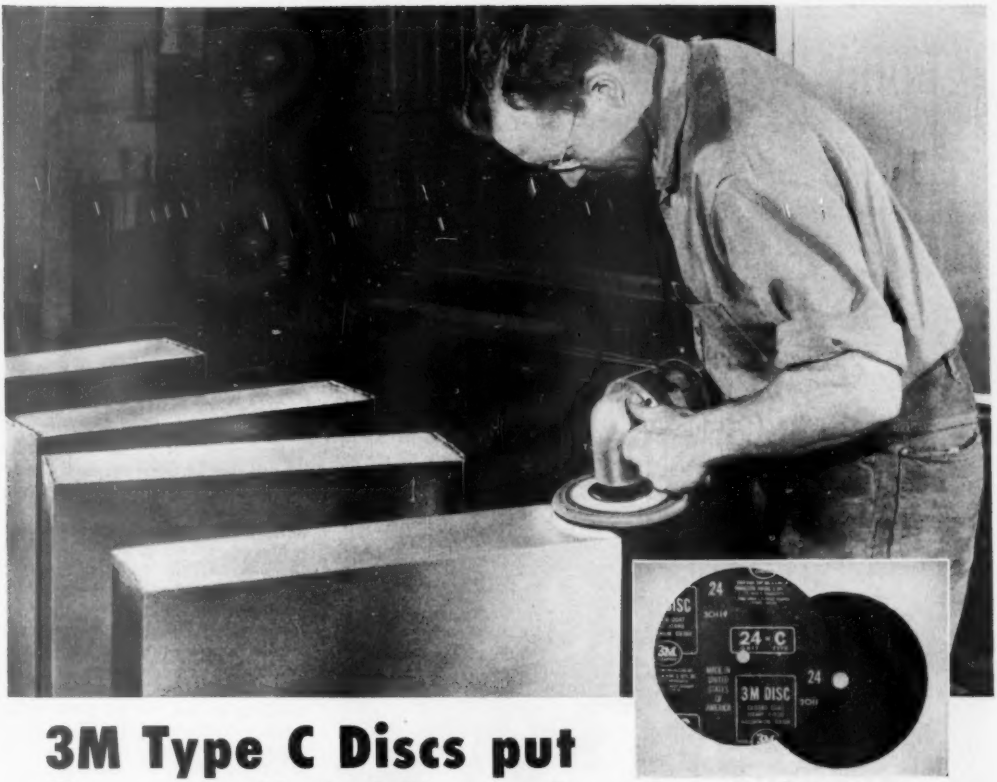

3M Type C Discs put "smart finish" on dumb waiters!

STAINLESS STEEL WELDS are smoothed down in record time at the Hauenstein & Burmeister Company with Grit 24 3M Type C Discs. This Minneapolis manufacturer tried other methods—then chose these outstanding discs to rough-grind the weld on stainless steel dumb waiter doors and door frames.

Reason? 3M Discs *cut faster, wear longer.* Operators found that even after grinding four complete dumb waiter units, a 3M Type C Disc was *still usable* . . . gave *bonus* service for aluminum weld and general solder sanding.

And it's 3M Abrasives ALL THE WAY for this cost and quality-conscious company! Three-M-ite Cloth Belts smooth out rough-grind and finish before polishing. Tri-M-ite Sheets do the final blending and polishing.

Want more information? Fill out and return the coupon below for complete facts on quick-cutting, long-lasting 3M Discs.

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stable even at lower heats

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PAGE Welding Electrodes AND Rods

Evaporation Method Helps Soldering of Titanium

HIGH vacuum evaporation techniques for the adhesion of electroplatings and solders to oxide-coated metals and glass are being developed at the Engineer Research and Development Laboratories, Fort Belvoir, Va. Occasion for the work is the fact that metals such as aluminum, chromium and titanium are sometimes difficult to solder because of their hard and tenacious oxide coatings.

It was decided to secure adhesion to these metals by a process that included their oxides. Outcome was the vacuum evaporation technique by which hard adherent oxide coatings can be caused to adhere tenaciously to their own and to other metallic oxides, including glass.

Vapors of two metals can be deposited simultaneously in such a manner as to eliminate the oxide coating that normally hinders adhesion. Thus, to coat titanium with copper, titanium is first evaporated on the oxide-coated titanium. At the first evidence of titanium deposition, the evaporation of copper is begun. When the first copper deposit appears, the titanium source is turned off and the copper evaporation continued until no titanium shows through the surface. The resulting surface can be soldered to directly or can be built up by electroplating. This method can be adopted to coating rolls or flat plates in a continuous coater.

Responsible for the investigations on adhesion of evaporated coatings is Noel W. Scott, physicist in the radiation branch of ERDL.

* * *

Big Show on Maintenance Planned for Next January

SIXTY-six separate sessions on maintenance problems have been scheduled for the coming Plant Maintenance Conference, which will be held at the Public Auditorium, Cleveland, Jan. 19-22, inclusive. The sessions, twice the number conducted last year, will take place concurrently with a plant maintenance show. L. C. Morrow, consulting editor, *Factory Management and Maintenance*, will be chairman.

There will also be three panels, 16 sectional conferences, 42 roundtables, four plant tours and a banquet.

Maintenance problems in 11 industries will come in for special discussions. These are: automotive, chemical, electrical manufacturing, food processing and packaging, foundries, paper mills and paper products, petroleum refining, printing and binding, rubber goods, steel mills and fabricating plants and textiles.

Cut Welding Time 40%!

GET { fewer rejects! / no burn-throughs! / 100% penetration! / X-ray quality!

Use a P&H AC Welder

— *the only welder with Instantaneous Control*

Ideal for use with inert gas. Lets you handle "hard-to-weld" metals with ease — aluminum, magnesium, brass, copper, stainless, high carbon, high alloy, and low carbon steels

A touch of your toe instantly gives you the exact heat you need — there's no time lag! That's how this P&H AC Welder gives you the instantaneous control you don't get with other welders.

When you use it on high frequency with inert gas, you can fabricate to close tolerances. And there's no burn-back to oxidize the metal before you get started.

The P&H Inert Gas Welder saves production time these five ways — no other welder makes the work so easy:

1. Foot switch automatically starts power, high frequency, gas, water.
2. Arc starts instantly without touching work.
3. Foot control instantly provides exact heat needed *while* welding.
4. Foot switch cuts power and high frequency immediately or gradually at completion of weld.
5. Automatic time delay shuts off gas and water.

There are other outstanding P&H AC Welder features: P&H Dial-lectric Control that eliminates moving parts — for lower maintenance cost, easier operation. Built-in high-frequency unit that eliminates additional external equipment. Stepless amperage regulation. Unusual arc stability. Selector switch that gives operator choice of standard or high frequency.

Cut *your* welding time for non-ferrous and "hard-to-weld" metals. Get faster, easier, sounder welds — fewer rejects. Use a P&H AC Welder.

Ask your P&H representative for further information — or write us.

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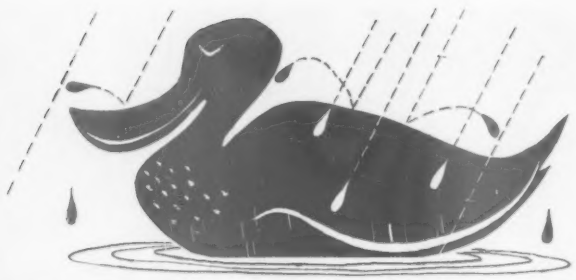

HOW TO DUCK THE WELD-SPATTER PROBLEM

Use Protect-O-Metal and weld spatter wipes off as easily as water from a duck's back! With Protect-O-Metal you speed welding and save up to 85% of weld cleaning time and labor. Brush or spray P. O. M. in weld seam and on adjacent metal—weld—then brush off spatter in seconds.

Just a little P. O. M. goes a long way too—costs less than 1/10c per foot of weld protected, saves up to three times its cost in time savings alone. Order a trial gallon ($3.25), satisfaction guaranteed or invoice will be cancelled.

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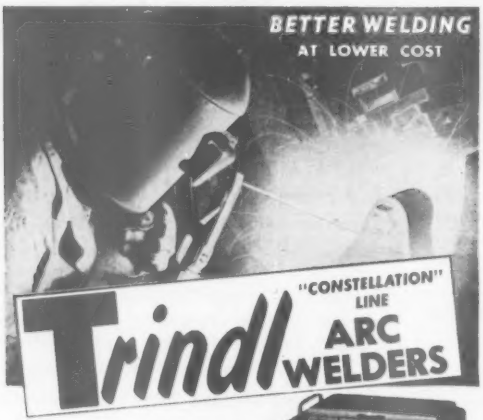


"CONSTELLATION" LINE
Trindl ARC WELDERS

Featuring a heat range from 30 to 400 amps, extra power capacity and a simplified method of heat selection. These welders handle a wide variety of production and maintenance welding applications.

Trindl welders are known for their dependable operating perfection, regardless of adverse conditions.

Eight popular models designed for industry shipped complete, including operating accessories.

Jobber inquiries invited

TRINDL PRODUCTS, LTD. 17 East 23rd St. Chicago 16, Ill.

X-Ray, Dye-Penetrant Talks at Philadelphia

INDUSTRIAL people interested in inspection of weldments and castings will find a lot of technical help at the Twelfth Annual Meeting of the Society for Non-Destructive Testing at the Hotel Sylvania, Philadelphia, on Oct. 20-23. The show will be held simultaneously with the annual meetings of the AWS, ASM, ASMME and the National Metals Show. The complete proceedings of the annual SNDT meeting are available at a cost of $10, which also covers a year's membership in the society.

Papers and authors include: Monday morning, The General Electric industrial betatron, T. W. Dietze, General Electric Co.; Modern techniques in precision high-voltage radiography, E. Alfred Burrill, High-Voltage Engineering Corp.; Low-voltage X-ray tubes with thin beryllium windows, Tom H. Rogers, Machlett Laboratories; Current status of the Picker-Polaroid process for one-minute radiography in industry, W. B. Pyle, Picker X-Ray Corp.; (to be read by title only) Direct exposure enlargement techniques in radiography and fluoroscopy utilizing fractional-focus X-ray tubes, Leo C. Kotraschek, North American Philips Co., Inc.

Monday afternoon: Reduction of exposure time in gamma radiography, J. J. Hirschfield and D. T. O'Connor, Naval Ordnance Laboratory; techniques used in measuring uniformity of materials by means of gamma radiation, Lawrence R. Megill and John N. Harris, Los Alamos Scientific Laboratories; Industrial applications of micro-radiography, S. Goldspiel and F. Bernstein, New York Naval Shipyards; Gaging tin coatings in the steel industry by X-ray fluorescence analysis, Frederick A. Behr, North American Philips Co., Inc.; (to be read by title only) Application of fluorescence X-Rays to metallurgical microradiography, Herman E. Seeman and H. R. Splettstosser, Eastman Kodak Co.; (by title only) Iridium-192 in Industrial Radiography, J. V. Rigbey and C. F. Baxter, Ford Motor Company of Canada, Ltd.

Tuesday morning: Film characteristics as applied to radiation monitoring, George Corney, Eastman Kodak Co.; Problems of mechanical film development, Donald F. Hauptman and Gerold H. Tenney, Los Alamos; Various pentrameter types and their limitations, Norman C. Miller and Gerold H. Tenney, Los Alamos; Interpretation of radiographs of aluminum and magnesium castings, J. J. Pierce, Naval Ordnance Labora-

Saved → $16,000.00 in one year

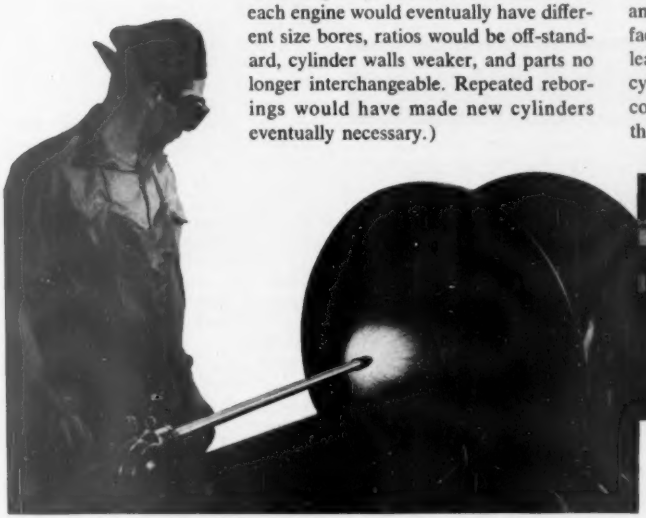
How one plant saved $16,000.00 in one year on one type of machine repair, with metallizing.

This large mid-West chemical plant uses fourteen gas engines, in compressor service, operating 24 hours a day. Fuel is a mixture of hydrogen, methane and air, with charcoal dust added to increase combustion efficiency.

Three methods of reconditioning these engines were available;

1. the cylinders could be replaced and standard sizes of other components preserved, at a cost of $450.00 per cylinder;
2. the cylinders could be rebored and fitted with oversized pistons and rings, at $400.00 per cylinder. (With this method, each engine would eventually have different size bores, ratios would be off-standard, cylinder walls weaker, and parts no longer interchangeable. Repeated reborings would have made new cylinders eventually necessary.)
3. Metallizing, at $125 to $150 a cylinder.

Cylinders are bored, threaded, grit-blasted, degreased and sprayed with Metcoloy #2 Stainless Steel, 20 to 30 pounds being applied. Cylinders are then finish-machined and honed to size. In the first year 64 cylinders were re-surfaced at a total saving of about $16,000.00, over the unsatisfactory method of reboring and fitting with oversized rings and pistons—$19,200.00 over the cost of new cylinders. Past experience with the greater particle hardness of sprayed metal, its better lubrication characteristics and the superiority of the stainless steel surface over the original cast steel cylinders leads this user to estimate that the rebuilt cylinders are good for another 15 years of continuous operation, about 50% more than the original life before reconditioning.



Gas engine—cylinders reconditioned with metallizing.

Gas engine cylinder—being metallized while rotating in improvised jig set-up.

Just One Example. This is just one among many money-saving applications of metallizing in this plant. Almost any rotating or sliding machine part subject to wear, can be reconditioned with this modern repair process. Parts are kept to standard sizes, replacement stocks can be cut, and production "downtime" caused by delivery delays or shortages of new parts is eliminated.

Further Information. Send off the coupon for a call by a factory-trained Metco Field Engineer, or a copy of Bulletin 54, *"Metallizing Saves Money"*.

The following trade names are the property of Metallizing Engineering Co., Inc., Metco, Metcoloy *Reg. U.S. Pat. Off.*

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☐ Please have Metco Field Engineer call.

☐ Please send me, without obligation, "METALLIZING SAVES MONEY".

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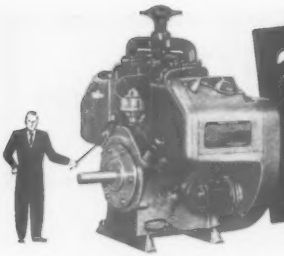


Why WISCONSIN FOUR-CYLINDER Air-Cooled ENGINES ARE ALL V-TYPE

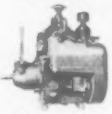
1. V-type design provides a more compact power package for easier, more adaptable installation on original equipment.
2. V-type design means lighter weight, adding to ease of handling and mobility.
3. V-type design provides most efficient air cooling — the air blast travels only half as far as required for a 4-cylinder "straight-in-line" engine.
4. More uniform cooling of V-type engines assures more economical and smoother engine performance; lower maintenance cost; longer engine life.
5. V-type cylinders are cast in pairs, 2 cylinders to a block, thus greatly reducing replacement cost if and when that should be necessary and simplifying servicing.

Wisconsin V-type 4-cylinder design is typical of the advanced engineering know-how that goes into all Wisconsin Engines . . . 4-cycle single cylinder, 2-cylinder and 4-cylinder models, in a complete power range from 3 to 30 hp. Write for detailed data.

V VE-4

15 to 21.5 hp.

V VF-4



17.5 to 25 hp.

V VP-4

26.8 to 31 hp.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46 WISCONSIN

YOU, TOO, WILL BE *"Sitting On Top of the World"* IF YOU USE

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HARD FACING ALLOYS FOR EVERY APPLICATION

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Be sure you're right—use **METALITE** for all your hard facing jobs. If you want a smooth application with maximum wear resistance switch to **METALITE** . . . the hard facing alloy which has been tested by time and proved by performance. Thousands of users testify to its superiority. Why be satisfied with anything but the best?

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METALITE C

ADAMS ALLOY CO.
WAKITA, OKLAHOMA

tory; (by title only) Semi-empirical equation for the spectral energy distribution in X-ray beams, Charles R. Emigh, Los Alamos.

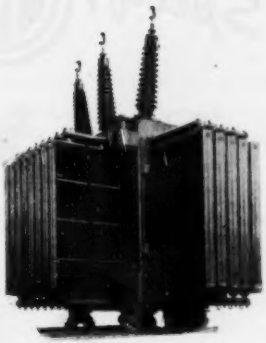
Tuesday afternoon: Economic factors in non-destructive testing, W. E. Thomas, Magnaflux Corp.; Quality control applications of non-destructive tests in the airframe industry which lower production cost, B. W. Clawson, Douglas Aircraft, Inc.; The use of non-destructive test methods in heavy manufacture, J. A. Pratt, Westinghouse Electric Corp.; (by title only) Bibliography of non-destructive testing, staff of the non-destructive testing laboratory, Battelle Memorial Institute.

Wednesday morning: Ultrasonic absorption—its relation to test interpretation and its correlation with service performance, Leslie W. Ball, U. S. Naval Test Station, Pasadena; Electronic reproduction of ultrasonic immersion images, Donald Erdman, Electro Circuits, Inc.; Ultrasonic examinations of weldments and the establishment of safe, acceptable limits for defects, Frank C. Parker, Carbide and Chemicals Co.; Ultrasonic equipment for high-precision thickness measurements, Peter K. Bloch, Branson Instrument Co.; Ultrasonic testing of cast iron pipe, G. B. Baumeister, Magnaflux Corp., Chicago; (by title only) Geophysics—its relation to non-destructive testing, Peter Dehlinger and Sam Wenk, Battelle Memorial Institute; (by title only) Economic industrial applications of the metroscope, Mr. Mann, Walter Kidde Co.; (by title only) Future trends in Industrial Ultrasonic Testing, William I. Bendz, Sperry Products, Inc.

Wednesday afternoon: Industrial evaluation of search-coil flaw detection techniques, George A. Darcy and Carleton E. Hastings, Watertown Arsenal; A metals comparator for the inspection and classification of metals, B. M. Smith, General Electric Co.; Industrial applications of eddy current testing, W. A. Cannon, Magnaflux Corp.; (by title only) New non-destructive test instruments developed by the Institut Dr. Forster.

Thursday morning: Comparison of materials for liquid-penetrant inspection, Hamilton Migel and Taber de Forest, Magnaflux Corp.; Lowered production costs with Turco Dy/Chek and Turco Chek-Spek, Gordon Rice, Turco Products, Inc.; The application of wire-resistance strain gages to lower production costs. Francis G. Tatnall, Baldwin-Lima-Hamilton Corp.; Filtered particle inspection of high-tension insulators, Henry N. Staats, Magnaflux Corp.

Look at this example of lowered production costs with MALLORY 22 *Seam Welding Wheels*



Typical Westinghouse power transformer showing Mallory 22 seam welded radiators in place.

To fabricate steel radiators like those shown at right above, Westinghouse uses Mallory 22 seam welding wheels on this continuous resistance welding machine which welds two, mated, flat steel sheets.

LOOK TO MALLORY FOR ALL YOUR RESISTANCE WELDING NEEDS

For 25 years Mallory has pioneered a wide range of developments in the resistance welding field—including many widely used alloys and a wide range of electrodes and holders. They offer top performance at low cost. Call on Mallory whenever you need copper base electrodes, holders, dies, castings, forgings, rods and bars for resistance welding applications.

In addition to a complete line of resistance welding products, Mallory offers unexcelled engineering service.

Production costs dropped for Westinghouse when Mallory 22 seam welding wheels were put to work welding radiators for power transformers. Westinghouse finds Mallory 22 wheels last longer . . . require fewer dressings . . . cut set-up time . . . thus help speed production and lower costs.

Mallory 22 metal, a copper base alloy containing cadmium and zirconium, offers high strength, high conductivity, and high ductility at elevated temperatures. These characteristics give it great resistance to mushrooming and cracking—thus making it the ideal wheel material for mash seam welding or similar applications where the welding heat is high and where cooling of the wheel may be necessarily inefficient.

Whatever your needs for seam welding wheels may be, it will pay you to put Mallory's facilities and experience to work for you. Call or write Mallory today, or get in touch with your local Mallory distributor.

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SERVING INDUSTRY WITH THESE PRODUCTS:
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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio.

Specify CMD CHIPPING HAMMERS

— The Finest Tools Made for EVERY Weld Cleaning Need

TYPE CB . . . A favorite for many years, this hammer is 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A . . . Drift and chisel of high-grade steel. Popular in malleable and grey iron foundries.

TYPES EB and FB . . . models E and F can be supplied with brush as shown here. Brush can be replaced.

TYPE E . . . head of high-grade steel has drift and chisel. Special hand grip absorbs shock.

Order from your dealer. Write today for descriptive circular 2-W.

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1928 WEST 46th STREET • CHICAGO 9, ILLINOIS

Group of RUEMELIN Fume Collectors Keeps Shop Clear of Welding Fumes

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes at the source with local exhaust hoods has proven most practical in operation. It is particularly helpful in winter months when doors and windows are closed. Write for Bulletin 37-D describing all types of Ruemelin Fume Collectors.

RUEMELIN MFG. CO.
MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

New Titanium Contract Calls for 13,500 Tons

A NEW agreement between the Defense Materials Procurement Agency and the E. I. du Pont de Nemours and Co., concerns production of 13,5000 short tons of titanium sponge over the next five years. This is three times the company's present plant capacity. To get the additional production, the government has agreed to advance the company up to $14,700,000 to expand its titanium producing facilities at Newport and Edge Moor, Dela.

According to Jess Larson, administrator of DMPA, the agreement with du Pont is designed to help meet the country's mounting needs for titanium until less costly methods for production of the metal than those now known can be developed. Present market price for titanium sponge is $5 per lb. Structural forms average about $15 a lb.

* * *

Railroads are Big Buyers From Steel Mills

RAILROADS last year bought about 8.6% of the total output of the nation's steel mills, according to the Eastern Railroad President's Conference.

Estimates indicate there are some 70,000,000 tons of steel rails in nearly 400,000 miles of railroad track in the United States. In addition, a modern Diesel locomotive represents 117 tons of steel, a sleeping car 70 tons and a box car nearly 40 tons.

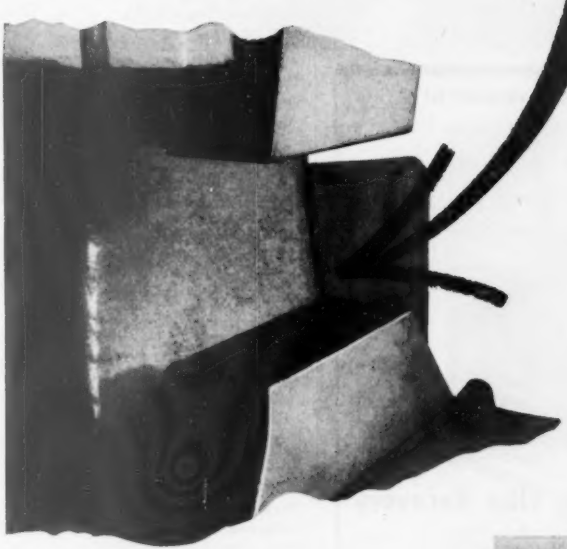
Average wholesale prices of steel products to the railroads have increased 110% since 1940. The cost of hauling these products by rail has risen only 78%, however. This single comparison shows the problems presented by increasing costs of railroad operation.

* * *

"He says he was daydreaming and welded himself inside!"

FOUR TIMES THE LIFE...

AND THESE HARD-FACED DIES ARE STILL GOOD



Flat dies formerly used in this blacksmith hammer had to be replaced every three months. Now the dies are protected with a ⅛-in. deposit of HASTELLOY alloy C. The ones shown here have already been in service for over a year, and are expected to last for six to eight months more.

Because the hammers are used almost constantly in a busy steel mill, unprotected dies wore to about ½-in. concavity in just three months' time. Then they had to be scrapped and replaced. When the dies that are hard-faced with HASTELLOY alloy C finally do wear, they can be machined and faced again.

HASTELLOY alloy C has been applied with outstanding success to many other hot-working parts. The alloy rod flows easily. No preheating or peening is necessary. Deposits can be machined with conventional die-sinking tools.

For information on how to apply HASTELLOY alloy C to hot-working parts, write for a copy of "HAYNES Hard-Facing Manual." For on-the-job help, write or phone our nearest District Office.

These hard-faced flat dies have already outlasted four unprotected ones. They are expected to outlast two to three more parts before requiring additional facing.

HAYNES TRADE-MARK *alloys*

"Haynes" and "Hastelloy" are trade-marks of Union Carbide and Carbon Corporation.

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
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General Offices and Works, Kokomo, Indiana
Sales Offices
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Los Angeles — New York — San Francisco — Tulsa

Weld with Wagner
ELECTRODE HOLDER
Gives long trouble-free service because it cools more readily, due to its patented channel construction. Designed for Welders by a Welder. This is one among many exclusive WAGNER features.
See Your Welding Supply Distributor
GROUND CLAMP
Practical engineering producing a ground clamp best suited for every Welders need. Enclosed spring, rugged construction with spring adjustment. Use WAGNER clamps to complete your welding circuit.

Wagner Manufacturing Co. JACKSON, MISSOURI

Welding Flux is expensive—it pays to recover it!

KENT SUCTION CLEANER for Flux Recovery

It quickly recovers unused flux for reuse . . . is as easily moved as your portable welder! And it's KENT-engineered for efficiency . . . built to last, with 39 years experience in the vacuum field behind it! It's shown in use above with portable welding equipment.

Full information upon request.

CLEAN WITH KENT EQUIPMENT

THE KENT COMPANY, INC., 436 CANAL ST., ROME, N. Y.

Tractor Sprocket Hubs Reclaimed by Welding

THE 35-IN. sprocket drive wheels used on a Caterpillar D7 tractor at Melbourne, Australia, needed a replacement because of worn teeth. The owners decided upon a welded repair and thus avoided the high cost of a new set of sprockets.

The machined hub, a valuable part, was saved by welding a new ring of sprocket teeth to a central section cut from the worn sprocket. Double-vee preparation was used on each spoke.

The old center section and the new toothed ring were conveniently positioned for joining on a stand made from a worn sprocket. A low-hydrogen lime-ferritic electrode was used. Single passes were made on one side of three spokes (out of nine), lying at 120 deg from each other. This skip-welding procedure minimized stresses and maintained concentricity of the toothed ring and hub.

Savings exceeded 80% of the cost of new sprockets.

—McGraw-Hill World News

• • •

Movie Highlights Engineering Career

A FULL-COLOR movie entitled "Miracles for Millions" was featured at the recent Centennial of Engineering in Chicago. This 16-mm film portrays the part that engineering has played in building the high standards of American living.

Main purpose of the movie is to interest more young people in engineering careers. To contact prospective engineers-of-tomorrow, the movie will be given special circulation in schools and before professional societies. It will also be available for church and civic bodies.

"Miracles for Millions" was produced by John Ott Pictures, Inc., Chicago, and will be distributed through the coast-to-coast offices of Ideal Pictures.

• • •

Germans Improve Ignitron Tubes

PROGRESS has been made by the AEG (Allgemeine Elektrizitats-Gesellschaft, Berlin-Frankfurt) tube factory in the development of mercury-vapor rectifiers (ignitron tubes). Such rectifiers are of considerable significance in the control of resistance-welding equipment. Without enlarging the outer dimensions to any extent, the maximum controllable capacity of the tubes has been increased from 270 kva to 330 kva.

—McGraw-Hill World News

Weldimatic means **Fully Automatic**

Weldit's Standard Water and Flame Inspection.

Sharp Eyes!

The trained, sharp eyes of Weldit inspectors are in no small way, responsible for the long service life of Weldit torches. From the metallurgical tests of the forgings and castings to the famous Weldit water and flame inspections, Weldit torches in the process of fabrication, are under rigid scrutiny. This results in the high efficiency, low operating cost and long life of Weldit torches.

Weldimatic **natural action!**
To light—squeeze, to shut off—release grip.

Illustrated, **WELDIT Model C-47** ***Weldimatic*** **Blowpipe.**

Weldit **INC.**
SINCE 1918

A limited number of Weldit Dealer franchises available.

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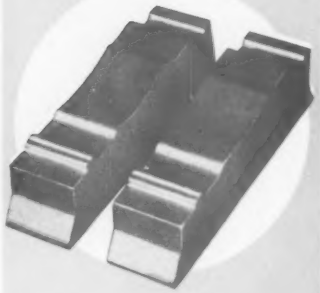

...that's why AMPCO WELD* Resistance Welding Dies Save You Time and Money

Just think — when you order "cast-to-shape," "cast-to-size" AMPCO WELD dies, they come to you with tolerances of minus 0, +1/32" or plus 0, −1/32". There's no machining, no time loss. All you have to do is just put in the cap-screw holes — and brother, you're in production.

You also get longer runs and lower costs, because these dies are made of alloys with high physical properties that meet or exceed RWMA specifications. If you're interested in longer runs for your money, place your order now for AMPCO WELD "cast-to-size" dies.

. . . and Ampco Engineering Service when you need it

Behind the famous AMPCO WELD line of resistance-welding products is a corps of experienced engineers, ready to help you solve your problems. Prompt service from these men is yours whenever you need it. Just get in touch with us.

RW-4

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AMPCO®

It's Production-Wise to Ampco-ize!

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

Cornell, Wisconsin Students Win A. F. Davis Awards

UNDERGRADUATE engineering students at Cornell University and the University of Wisconsin have won the 1951-52 A. F. Davis Undergraduate Welding Awards. The two Cornell men, Paul J. Wisniewski and David A. Thomas, won the first prize of $200 with their paper on metal transfer in arc welding, which appeared in the April, 1952, issue of *The Cornell Engineer*. The college magazine will also receive $200 for publishing the winning paper.

A Wisconsin senior, Norman Fletcher, has been selected as winner of the second prize of $150. His prize-winning paper on the subject of "Arc Welded Machine Jigs" was published in the Nov., 1951, issue of *The Wisconsin Engineer*. The publication will receive $150 also.

Award certificates will be presented to the winners on Monday, Oct. 20, 1952, at special ceremonies during the national meeting of the American Welding Society at Philadelphia.

The award program is named for its sponsor, A. F. Davis, vice-president and secretary of The Lincoln Electric Co., Cleveland.

* * *

"Skilsaw" Changes Name to Skil Corp.

SKILSAW, INC., Chicago manufacturer of portable electric and pneumatic tools, has changed its name to Skil Corporation. The change became effective October 1.

In announcing the change, President Bolton Sullivan explained:

"We have simply outgrown the name Skilsaw. During our 28-year history, the product line has expanded from one portable electric saw to over 150 different tools. This enormous expansion has left the name "Skilsaw" limited in its descriptive value since we manufacture not only saws but also many other types of portable power tools, including drills sanders, grinders, drivers and polishers."

* * *

Temco Get Contract For F3H Jet Fighter

TEMCO Aircraft Corp., Dallas, Tex., has signed a licensing agreement with McDonnell Aircraft Corp., St. Louis, Mo., and has been awarded a prime contract by the Navy to produce an undisclosed number of McDonnell F3H single-jet, carrier-based fighters. The F3H Demon was one of the types of U. S. jet fighters recently cited by Secretary of the Navy Dan Kimball as being better than the Russian MIG-15.

SPATTER CHATTER

Here's a COOL baby

not half so cool as

cam-lok ELECTRODE HOLDERS

Cam-Lok Holders are really cool performers! Properly sized for 500, 300 and 200 ampere ratings, they have many other features which make them the first new, really improved holders in years: fast one-hand operation, newest type insulation, simple and rugged mechanism. Cam-Lok Welding Electrode Holders cost no more, save on maintenance, give far longer life and more inches-per-hour welding.

Also hailed by welders and engineers: Cam-Lok Cable Connectors, solid brass low resistance couplings without adapters.

New FREE Catalog
WRITE TODAY

cam-lok

DIVISION OF EMPIRE PRODUCTS, INC.
P. O. Box 98-F Cincinnati 36, Ohio

NLRB Ruling Affects Work Assignments

A CONTRACTOR who did not personally stipulate that he would be bound by the decisions of the National Joint Board for Settlement of Jurisdictional Disputes will not be prevented by the Taft-Hartley labor law from making his own work assignments.

This is the rule even though the contractor is a member of an association which agreed to the AFL-construction industry machinery for settling jurisdictional disputes. It makes no difference, either, that the joint board, headed by John T. Dunlop, may have issued a decision in the dispute.

This is the decision of the National Labor Relations Board in a dispute between Empire State Painting & Waterproofing Co., Buffalo, and the AFL operating engineers over the operation of an air compressor.

Richard J. Gray, president of the AFL Building Trades Dept. and a member of the Dunlop board, attacked the decision as raising doubt as to whether any contractors are bound to comply with the rulings of the union-industry board.

"The building trades are bound, but apparently not all of the contractors," Gray commented.

Trouble with the operating engineers began in November when Empire State began painting a warehouse in Buffalo. Seven men were assigned to this particular job. An air compressor was needed to operate a chipping hammer used to chip concrete from a wall preparatory to painting it. The contractor used a laborer, to turn the compressor on and off and oil it. The operating engineers filed a case with the Dunlop board when Empire State refused to give the work to one of their members. Its decision said, that under existing decisions and precedent, the work properly belonged to an operating engineer. Empire State ignored the decision, so the union picketed and kept other union men from working. The contractor filed a charge with NLRB accusing the operating engineer of illegally trying to force him to assign work in violation of Taft-Hartley. NLRB upheld Empire State without deciding which union is entitled to run the air compressor.

* * *

American Brake Shoe Opens Forging Plant

AMERICAN Brake Shoe Co. has started production at its new steel forging plant in Azusa, Calif., which is operated by the company's AmForge Div.

YOU CAN DO ALL OF THESE JOBS!

It's amazing how *versatile* Smith Welding Equipment is. That's because Smith's ingenious design permits quick attachment of accessories for special purpose work. All accessories fit one torch body. Insert one tip—and weld. Insert Cutting Assembly—and do cutting.

No wrench necessary—fingers do the job. For Smith's Lifelong Heavy Duty Torch Body, there are 10 different accessories for as wide a variety of work as a normal shop would ever be called upon to produce. Other Smith torches have similar versatility. Tips can be changed in 6 seconds. Standardize on Smith for efficiency. Write for information.

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No wrench necessary. Easy twist of fingers does the job—makes gas-tight seal. Fast line-up of tip. Fast change from welding to cutting.

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. . . and still maintain maximum safety standards!

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Atlantic Grinding Wheels provide maximum wheel strength for continuous, high-speed operation. They're made with a special resinoid bond to assure extra wear. They're faster . . . cooler running . . . freer and cleaner cutting! Their smooth, floating action requires less pressure and makes work easy. They *seldom have to be dressed* . . . eliminate the need for frequent replacements . . . lower operating costs. Best of all, every Atlantic Wheel made — from the 2 inch size right on up — is test run at a 50% higher speed than that required for normal snagging operations. That means a greater margin of safety . . . on job after job . . . from start to finish.

CHECK THESE time and money-saving Atlantic advantages for yourself. Send for the new Atlantic Grinding Wheel Catalog today — get the full facts on Atlantic Speed-Tested Wheels for every job in the shop. Atlantic Abrasive Corp., 545 Pearl St., So. Braintree, Mass.

ATLANTIC ABRASIVE CORP.
South Braintree 85, Massachusetts

Weldwire Company Marks First Birthday

THE Weldwire Co., Inc., Philadelphia, recently observed its first year in business as a manufacturer of arc welding electrodes. The firm is located at Emerald and Hagert Streets in Philadelphia.

President of the firm is Julian S. Kobler, who holds a law degree from Rutgers and a liberal arts degree from the University of Pennsylvania. His experience includes eight years in quality control, production management and electrode coating research for a leading stainless and alloy electrode manager.

Jerome J. J. Schlass, sales vice-president, obtained his degree in metallurgical engineering from the University of Wisconsin and is a registered professional engineer. He has done welding engineering work on earth moving equipment, steels in ship construction, electrode coating development as well as numerous field application jobs on welded construction.

David Rozet, vice-president in research and development, has a doctor of science degree from the University of Brussels. He has been in welding for 16 years as chief chemist and research chemist for a prominent stainless electrode manufacturer. He has written numerous articles for technical journals besides his developmental work.

Ruth S. Kobler is treasurer of the firm and also serves as chief chemist, having received a B. A. degree in chemistry from Penn. She previously directed the analytical laboratory of an electrode manufacturer. Irving W. Singer, secretary of the company, received B. A. and law degrees from Temple, and serves as legal counsel.

• • •

Michigan Copper Mine To be Reopened

THE big Osceola Mine of the Calumet & Hecla Consolidated Copper Co. in Houghton County, Mich., will be reopened under an agreement with the Defense Materials Procurement Agency. The Osceola has been closed down since 1931 and is full of water, as is an interconnected mine, the Conglomerate, which was closed in the late 1930's.

The contract calls for production of 53,000 short tons of refined copper from the Osceola by mid-1962. Before any copper comes out, though, it will be necessary to remove about 7,000,000,000 gallons of water, enough to make a lake 7 ft deep and 5 sq miles in area. The "unwatering" operation will take 530 days, engineers estimate.

Portable Welder Frame Makes Aero-Sled

AN old engine-driven welder frame is now skimming over the Alaskan snow fields as the chassis of a propeller-driven aero-sled. Named "It Won't Work," the sled was built by members of the U. S. Naval Construction Battalion, Detachment 1801, located at Point Barrow, Alaska.

It is powered by a salvaged 95-hp auto engine which feeds two salvaged jeep differentials coupled to a light plane aircraft propeller purchased in Fairbanks. It has a windshield of ¼-in. plexiglas and a body made of ¼-in. plywood mounted over ½-in. angle iron. Top speed is estimated at 50 mph, according to *All Hands*, a Navy publication.

* * *

Industrial X-Ray Unit Saves Time and Money

A NEW 250-kv industrial X-ray unit, recently installed in the Sunnyvale, Calif., plant of Westinghouse Electric Corp., is expected to pay for itself in less than five years through savings on the rental of radium alone. The machine can X-ray specimens 50 to 60 times faster than was previously possible with either radium or radioactive cobalt.

This X-ray unit, a Westinghouse product, will be used to explore castings and weldments for internal defects such as shrinkage, cracks, porosity, etc. Steel castings and weldments up to 2½ in. thick are being X-rayed by this machine. Castings and weldments from 2½ to 6 in. thick are radiographed by means of radioactive cobalt as it is less expensive than radium.

* * *

Tool Engineers Install 100th Chapter—Celebrate

AN EXTENSIVE program has been planned for the chartering of the 100th Chapter of the American Society of Tool Engineers. The ceremony will take place in Memorial Hall, Athol, Mass., on the evening of Oct. 14, 1952. As part of the program, the plants of the L. S. Starrett Co. and Union Twist Drill Co. will be toured by the more than 500 members and guests expected to attend the chartering. A get-acquainted gathering will be held in the Pequoig Hotel preceding the banquet.

The new chapter, which will be known as the North Central Massachusetts Chapter, marks a milestone in the growth of the ASTE, which is this year celebrating its 20th anniversary. Membership as of August 15 was 22,391 members.

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Oil Industry to Use More Aluminum Pipe, Plate

WITHIN a few years, the oil and gas industry will be one of the largest users of aluminum, thinks Reynolds Metals Co. More than 20 different oil firms, some of them top rankers, are doing aluminum development work in cooperation with Reynolds.

Specifically mentioned by David P. Reynolds, sales vice-president, as promising products are sucker rods, well tubing, aluminum oil and gas lines and certain oil field tanks, drill rigs and servicing units.

Steel drill rigs are said to suffer in mobility and portability over the one-third-as-heavy aluminum structures now in design stage. Reynolds adds that in many states it is illegal to operate such steel servicing units on state and federal highways at their present weight. Designs for a truck-mounted aluminum servicing unit show it will cost $60,000 but will reduce the weight by at least 15,000 lb.

Storage tanks for sour crude oils containing sulphur gases have heretofore undergone severe corrosion in their deck or roof structures. This condition is caused by the mixture of sulphur gas with water vapor to form sulphuric acid droplets on the tank roofs. Aluminum roofs, however, are not attacked by the sulphur gases.

Result is, aluminum roofs, supporting structures, hatches, vent lines and other fittings are going into tanks in sour crude areas. Fabricators in Kansas City alone have used more than 1,000,000 lb of aluminum in decks for these tanks.

Lightweight shot-hole casing that can be transported in helicopters is becoming more and more popular, for the many exploration treks oil companies must engage in. In this same endeavor, aluminum is being used in dynamite trailers, shot-hole drills, swamp buggies, instrument cases, temporary liners, truck bodies, etc.

Aluminum condenser tubings and fin stocks are going into more and more heat exchangers in oil refineries, reports Reynolds. Some 30% of the cost of a refinery goes for heat exchangers, it finds.

The weight advantage of aluminum over steel gives it an economic advantage when it goes into pipe lines that must traverse swamps, soar over river crossings, climb over mountain ranges or be strung across lakes. The inert-arc welded natural gas line crossing the north fork of the Little Colorado River near Bowie, Okla., carries sweet natural gas at 250 psi. The 10¼-in. diameter, 3/16-in. wall pipe spans 318 ft between piers. A

single 1¼-in. steel cable supports the entire pipe system. Aluminum flanges at each end of the crossing are bolted to adjoining steel line flanges. Any possibility of galvanic attack is avoided by insulating the dissimilar metal flanges by Micarta tubes and gaskets.

For underground lines, a number of test installations show the feasibility of installing welded aluminum pipelines. Early in 1950, the Alabama-Tennessee Natural Gas Co. installed a 1.8-mile length of a gas line to serve Reynolds Metals' Listerhill, Alabama, plant, see THE WELDING ENGINEER, page 26-29, July, 1950). A 40-ft by-pass was installed on this line with a bare section included to provide a basis for watching corrosion effects. When the pipe was dug up 17 months later careful inspection of the pipe, inside and out, revealed no discoloration or corrosion of any sort. Officials of the gas company agreed with Reynolds engineers that this bare aluminum pipe would last indefinitely under these soil conditions.

* * *

Weldaloy Publishes R-W Products Catalog

PRODUCTION of the new company catalog for Weldaloy Products Co., Detroit, involved many special photographs and the use of specially colored inks and papers. Totaling 112 pages, it was written to provide a complete directory of resistance welding materials for the company's customers. Many pages of dimensions, drawings and diagrams illustrate each type of electrode and explain its features. Combinations of tips and holders, hints on preventing "buckle," graphs of electrode force and welding pressure and many tables of spot welding data on carbon and stainless steels and other metals are included.

Free copies of this catalog can be obtained by writing to Weldaloy Products Co., 2323 East Nine Mile Rd., Hazel Park, Mich.

* * *

Belden Starts Fifty-First Year

BELDEN Mfg. Co., Chicago, makers of welding cable, power cable, magnet wire and other electrical products, marked its 50th year in business on Sept 23 with a small open house. Starting in the early days of the welding business, Belden has always been prominent in keeping up with the growing needs of arc welding, designing new strand arrangements, separators and jackets for various needs. The welding industry joins in general congratulations to Belden in the starting of its 51st season.

Your Stainless Steel business will grow like magic WITH U·S·S 17 STAINLESS (TYPE 430)

U·S·S 17 (Type 430) Stainless Steel is a non-nickel bearing stainless that has already proved itself a satisfactory alternate material for the nickel-chrome grades of stainless. It is available from our warehouse stocks and is *not* subject to government restrictions.

Improved fabrication techniques that you can easily apply in your plant will make it possible to do a good job with U·S·S 17 Stainless.

DON'T TURN DOWN STAINLESS STEEL BUSINESS without checking our nearest warehouse about the practicality of using U·S·S 17 Stainless. We can give you complete information about fabricating techniques and suitability of application. If you need this information in a hurry, ask your U. S. Steel Supply salesman. Or use the attached coupon.

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THAN SINGLE HEADED HAMMERS

Illustrated Model No. MP-2-M $2.40 each—quantity prices 10% to 20% less.
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Silvaloy 355 is a low temperature cadmium-free alloy especially adapted for brazing of food handling and dairy equipment, and where a close color match is desired.

Silvaloy 50 and 45 are extremely fluid. Free-flowing at temperatures of 1145° F. to 1295° F. Especially designed for production brazing on stainless steel.

GAS AND ARC WELDING ELECTRODES FOR THE WELDING OF STAINLESS STEEL
Coated rods in either A.C. or D.C. Titania coated or Lime D.C. coated.

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Use 1200 Flux for silver brazing Brass, Stainless Steel, Bronze, Nickel-Silver, Steel, Monel, Inconel, Nickel and Cast Iron. Furnished in ½ lb., 1 lb., 5 lb., and 30 lb. containers.

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Ludwig Fellowship Fund Set Up by Westinghouse

A FELLOWSHIP fund to help promising young engineers and scientists of the Westinghouse Electric Corporation continue their studies at a graduate level has been established in honor of the late Leon R. Ludwig, outstanding inventor and Westinghouse engineering executive.

Announcement of the educational trust was made by A. C. Monteith, Westinghouse vice-president in charge of engineering, who also is a member of the fellowship committee which will administer the fund. Mr. Ludwig's widow, Mrs. Agnes S. Ludwig, and daughter, Martha, established the fund at the time of the Westinghouse executive's death in Nov., 1951.

A prolific inventor, he had more than 70 patents to his credit and during World War II made important contributions to the development of the atomic bomb. One of his most outstanding achievements in the field of electrical engineering was the development in collaboration with Dr. Joseph Slepian of the ignitron rectifier. Mr. Ludwig came with Westinghouse in 1925 as a student engineer and at the time of his death was director of research and engineering for the company's atomic power division.

The fellowship fund established in his name will be administered initially by five Westinghouse officers. They are Gwilym A. Price, president; Dr. J. A. Hutcheson, vice-president and director of research; Andrew H. Phelps, vice-president in charge of purchasing and traffic; George G. Main, treasurer and Mr. Monteith.

• • •

Raytheon Opens New Branch Office

RAYTHEON Mfg. Co., of Waltham, Mass., has officially opened its new office building in Cleveland. The building, which is located at 3076 W. 117th St., was especially constructed for Raytheon and provides ample office space and display rooms for demonstration purposes.

• • •

Role of Research Discussed at Conference

A CENTENNIAL Conference on Industrial Research was scheduled to be held last month at the Armour Research Foundation of the Illinois Institute of Technology, Chicago. Research objectives, trends and opportunities for the future were to be evaluated. Welding was one of the 19 items up for special discussion on the program.

Nelson Promotion Wins Two Awards

NELSON Stud Welding division of Gregory Industries, Inc., Lorain, O., has received two of the 35 awards that are given by a jury of five architects for outstanding product literature of the past year. The contest was limited to manufacturers and producers in the building field.

The awards to Nelson were honorable mentions in two classes: for literature offering technical information and for promotional literature. Credit for this fine work goes to William J. Kane, vice-president in charge of construction industry sales, and S. E. Lapp, advertising manager.

The awards are sponsored jointly by the American Institute of Architects and the Producers Council.

* * *

Eutectic Welding School Announces Fall Schedule

A REGULAR schedule of weekly classes in advanced welding techniques started Sept. 15 at the Eutectic Welding Institute, Eutectic Welding Alloys Corp., Flushing, N. Y. A new session commences every two weeks until the end of the year. For detailed course outlines, schedules and other information on this non-profit educational activity, write to Eutectic at 172nd St at Northern Blvd., Flushing 58, N. Y.

* * *

New Plant Welds Steel Tote Boxes

STEWART PARKER Co., Pittsburgh manufacturer of all-steel tote boxes, is making an interesting use of spot welding in its new plant. The "Custom-Built" tote box is made in one piece, folded at ends and welded throughout. A triple fold top perimeter increases durability. Handles are secured by spot welds and folded under the top rim for safety.

* * *

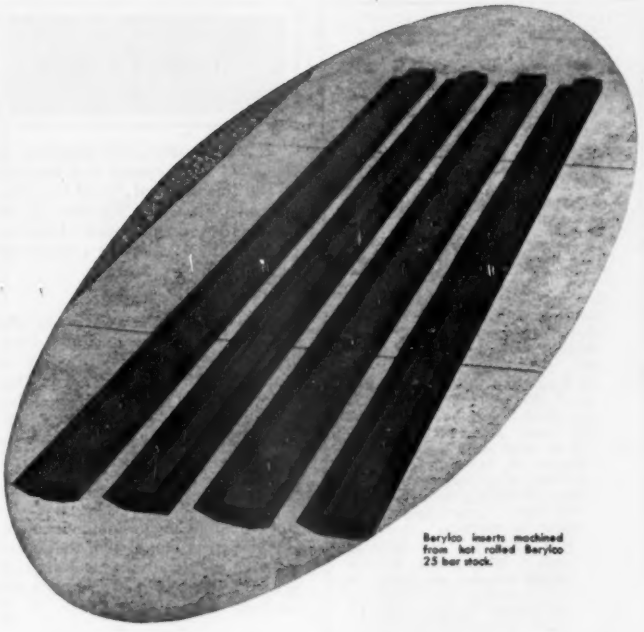
Russians Erect 27-Story Welded Building

A Russian magazine, *The Literary Gazette*, recently announced completion of the first post-war Moscow skyscraper. Says the magazine, "nobody but Soviet engineers could have welded such giant metal frames."

The 27-story government building is said to have 2,000 air-conditioned offices, each with an electric clock. The new structure is to house administrative bureaus.

* * *

A highbrow is a person educated beyond his intelligence.—Brander Matthews



Berylco inserts machined from hot rolled Berylco 25 bar stock.

BERYLCO BERYLLIUM COPPER FOR FLASH WELDING gives smooth, sound welds—greater production—longer life

Many steel mills find that Berylco beryllium copper inserts offer distinct advantages over solid dies in flash welding.

To give the best results, inserts must resist wear and mushrooming, in addition to providing good electrical conductivity. Berylco beryllium copper, the standard RWMA Class 4 insert material, has greater strength and higher conductivity than any material used in the past. Berylco inserts last longer—over-all maintenance costs are less.

Berylco inserts also require less frequent dressing. That's because the flash produced in welding does not adhere to Berylco as readily as it does to other materials. Production benefits from decreased downtime . . . and you get smoother and sounder welds.

Although it is sometimes necessary to cast or forge Berylco dies for special applications, many standard inserts can easily be machined from hot-rolled bar stock. A tougher, more uniform insert is obtained by using wrought material.

BERYLCO BERYLLIUM COPPER IS AVAILABLE IN ROD AND BAR STOCK AND IN STANDARD SIZE WHEELS.

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IN THE ICE AGE

mammoths were caught in traps and killed with rocks. Nowadays, big game is killed by simply bending the index finger.

50 years ago the hand cutting torch was a sensational novelty. Now it has been replaced by more efficient machines. It is now only used where expensive, template-operated cutting machines would not be economical, such as building sites, storage dumps and small workshops.

But here too its fate is sealed. The small MINIMOR cutting machine (it is portable, fits into a briefcase, weighs only 11 lb!), developed by Weberwerke, requires no more run-in than a hand torch, yet the speed and accuracy of its cut are far superior. (Bevel cutting, short straight runs, circular cuts of 1¾ inch diameter!) Please ask for our leaflet MIN 1. The MINIMOR produces

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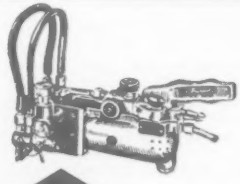

MINIMOR

WEBER WERKE
SIEGEN WESTF.
GERMANY

About People

T. H. WICKENDEN, vice-president in charge of development and research of The International Nickel Co., Inc., has been elected a member of the Welding Research Council of the Engineering Foundation for a three-year term beginning Oct. 1.

* * *

SANDS G. FALK has been appointed manager of the new combined foundry and weldment sales division of Falk Corp., Milwaukee. DAVE P. MILLER will handle weldment and casting sales, while STEWARD C. HAGEN, who recently transferred from the foundry operating division, will concentrate on steel castings.

* * *

JOHN B. JOBE has been appointed assistant district manager of the Johns-Manville industrial products division at Los Angeles. He has been with the company since 1936.

* * *

JAMES H. LOWE has been appointed product development director of Steel Founders' Society of America. He was formerly technical and research director of Wehr Steel Co., Milwaukee.

* * *

J. P. D. GERRESE has been appointed chief engineer of the Gary plant of National Tube Div., United States Steel Co. Born and educated in Holland, he joined the company in 1925 as a draftsman. Since 1947, he has been control engineer of the construction department of National Tube.

* * *

LINN LOSHBOUGH retired last month after 50 years' service with the General Electric Co. Originally hired as an office boy at $3.50 per week, Mr. Loshbough rose to supervisor of engineering service for the Chicago apparatus office, a position he had held for many years.

* * *

WILLIAM N. JOVE, 63, Norton Co. abrasive engineer in Chicago, recently became the company's fifteenth 50-year man. He is still active and covers a territory in Chicago made up of 20 large accounts.

* * *

HAROLD PRINCE was appointed advertising manager of the Amer. Silver Co., Flushing, N.Y. He will be in charge of the company's advertising, publicity, and sales promotion campaigns.

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WELDING COMPOUNDS AND FLUXES

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8—Aluminum Flux
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
16—Silver Solder Paste Flux

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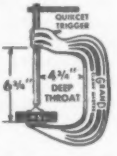
A S L SERIES

SAVE MINUTES ON EVERY CLAMPING OPERATION!

Grand Speed Clamps are quick setting and instant releasing—just push down the screw and tighten with a turn on the vise-type handle. Trigger releases work instantly.



Grand Speed Clamps have extra deep throats—are ruggedly built of NACO No. 6 Steel—spatter proofed.

4 Sizes: 2" to 8" Opening

Famous GRAND "C" Clamps

Alloy Steel (Stronger than forged) Spatter-Proofed Screws, Deep Throat—Replaceable Swivels

LIGHT SERVICE SERIES	MEDIUM SERVICE SERIES	HEAVY SERVICE SERIES
L SERIES	ASM SERIES	ASH SERIES
8 SIZES 2" TO 12"	7 SIZES 4" TO 18"	8 SIZES ¾" TO 12½"

Ask Your Supplier

GRAND SPECIALTIES CO.
3101 W. GRAND AVE., CHICAGO 22

THOMAS S. COLLINS was appointed the Chicago electrode representative for The McKay Co., Pittsburgh, Pa. His headquarters are at 1500 S. Western Ave. in Chicago. Mr. Collins will cover northeastern Illinois and northwestern Indiana and will handle sales and service for the entire line of McKay arc welding electrodes. He comes to The McKay Co. from Industrial Tape Corp., Chicago.

* * *

DR. MAURICE J. DAY, metallurgical engineer at U.S. Steel Co., Pittsburgh, has been named manager of the materials and processes division at Armour Research Foundation of Illinois Institute of Technology. As manager of the materials and processes division, Dr. Day will direct research and development activities of 300 scientists and administrative personnel. The division includes chemistry and chemical engineering, ceramics and minerals, and metals research departments. A national committee member and former chairman of the Chicago chapter of ASM, he is also affiliated with AIMME and AWS.

* * *

J. H. BRINKER has been appointed assistant executive in charge of distribution at A. O. Smith Corp. in Milwaukee. He was formerly the general sales manager for the southwest district, located in Houston. Mr. Brinker will supervise advertising and sales promotion, exhibits and displays and market analysis for A. O. Smith.

* * *

MILTON F. BEECHER, head of Norton Company's research and development laboratories since 1941, has retired from his position of vice-president and director. He will be succeeded by WALLACE L. HOWE, director of research and development.

* * *

NORMAN PINTCHUK has joined Solar Aircraft Company's San Diego plant as foundry metallurgist in Solar's stainless steel foundry. He was formerly with the manufacturing research division of International Harvester Co. in Chicago.

* * *

PAUL R. LARIMER was appointed general sales manager of Ansul Chemical Co., Marinette, Wisc. He will be in charge of four sales divisions: fire extinguisher, refrigeration, industrial chemicals and export.

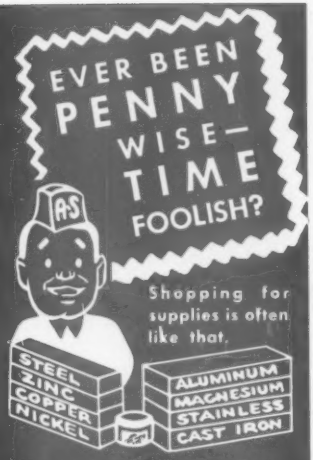
* * *

LYMAN M. CAMPBELL was appointed chief development engineer of The Liquid Carbonic Corp., Chicago. Mr. Campbell was formerly chief engineer of The Globe Co. of Chicago.

For information on where to buy welding equipment, supplies and accessories, consult your Mid-June Product and Statistical Review Number. There you will find manufacturers of welding products used in and for welding.

●

THE WELDING ENGINEER



Now is the time to investigate the important services your nearby All-State Distributor offers.

1. ONE SOURCE OF SUPPLY

It makes sense to make your A-S Distributor and All-State your one proven source for all alloys and fluxes needed for welding, brazing, soldering, tinning and cutting.

2. BETTER JOBS FOR LESS

A-S Distributors stock a large variety of things you have to have quickly when you want them. They're competitive on price — usually lower if your eye is on the job costs. That comes of their handling All-State Alloys and Fluxes for all metals. They do better jobs for less.

3. TECHNICAL SERVICE

Each All-State Distributor has men especially qualified by training and experience to aid in the proper selection and use of alloys and fluxes for jobs where you might need help. Back of them, and always ready to pitch in on the problem jobs are the All-State regional men and the well-known All-State technical service facilities at White Plains, N. Y.

4. FREE LITERATURE

Ask for 32-page Buyers Guide to the complete line of All-State Alloys and Fluxes for welding, brazing, soldering, tinning and cutting.

A-S DISTRIBUTORS EVERYWHERE

All-State

ALL-STATE

WELDING ALLOYS CO., INC.
White Plains, N. Y.

GEORGE J. ZIPF has been named district manager in charge of sales and service for the Chicago district of the Raytheon Mfg. Co. The Raytheon Chicago district has offices at 5016 W. Madison St., Chicago, and serves the area of Indiana, Western Kentucky, Wisconsin, Illinois, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas.

• • •

R. JOE HAYES was named sales representative of the Mo-Kan-Ark area for Titan Metal Mfg. Co., Bellefonte, Pa. Mr. Hayes has 20 years' experience in the non-ferrous field. He will have charge of the company's office at 3920 Lindell Blvd., St. Louis 8, Mo., covering Missouri, Iowa, Kansas, Arkansas, Oklahoma, Southern Illinois and Northwestern Texas.

• • •

T. A. SULLIVAN, supervisor of order service in the A. O. Smith Corp., Milwaukee, process equipment division, has been named product manager for the pressure vessels in the division. R. T. SPRINGATE has joined the division as superintendent of production control. He has been factory manager of the A. O. Smith truck frame division. Succeeding Mr. Springate at the truck frame job is T. E. DILLON, formerly manager of manufacturing for the passenger frame plants.

• • •

JAMES A. RABBITT, Inco consulting engineer and authority on Japan and the far east, has retired from The International Nickel Co., Inc. after more than 22 years. During World War II, he served the United States as technical consultant on Japanese industries. He was also a member of the panel of far eastern experts in Washington.

• • •

WILLIAM J. KINGSLEY has been made assistant general sales manager of The Carborundum Co., Niagara Falls, N. Y. He has been with Carborundum since 1922, when he joined the sales engineering department.

• • •

ALEXANDER PECHMAN, ceramic engineer, has joined the staff of the development laboratory at Ryan Aeronautical Co., San Diego. He will work on Ryan's program of ceramic coated parts for jet, rocket and internal combustion engines.

• • •

J. T. CATALDO was appointed assistant general manager of International Rectifier Corp. of El Segundo, Calif. He is a member of the Institute of Radio Engineers and the AIEE Metallic Rectifier Committee.

Fuse-Well

CAST IRON RODS & ELECTRODES

"The Name to Specify When You Buy!"

- **"Fuse-Well"** { NO. 11—SQUARE / NO. 12—ROUND } (Cast Iron Acetylene Rod)
- **"Fuse-Well" NO. 14 — SQUARE** (Alloy Rod—Moly Hi-Strength)
- **"Fuse-Well" NO. 22** (Coated Machineable Electrode)
- **"Fuse-Well" NO. 19** (Coated Hard-Surfacing Electrode)
- **"Fuse-Well"** { NO. 21—SQUARE / NO. 26—ROUND } (5% Silicon—Cast Aluminum Rod)

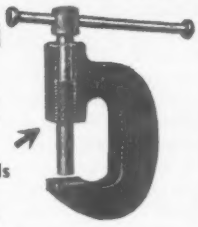
"Flux-Well" Welding Fluxes — Fuse-Well Cast Welding Rods — Wrenches for Acetylene Tanks

Sold Thru Leading Distributors

THE CHICAGO HARDWARE FOUNDRY CO.
"DEPENDABLE SINCE 1897"
2500 N. COMMONWEALTH AVE., NORTH CHICAGO, ILL.

"Red Head" WELDING CLAMPS

- Designed for Welding
- No Threads To Damage



1. Case Hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1969 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

W. Roy Widdoes, director of industrial relations at Lukens Steel Co. since 1949, has been appointed to the president's staff. He will be secretary of the management committee in charge of future company planning. William C. Robinson, currently assistant director of industrial relations, will succeed Mr. Widdoes as director.

* * *

Tom Murphy was recently promoted to chief engineer of the Condenser Products Co. of Chicago. He heads a research and development department now comprised of eleven engineers.

* * *

Roger M. Blough has been elected a director of United States Steel Corp. and a member of its finance committee. He has been vice-chairman of the board since spring of this year and also executive vice-president (law) and secretary.

* * *

Colonel Herbert Milwait has assumed command of the Engineer Research and Development Laboratories, Ft. Belvoir, Va.

* * *

Died . . .

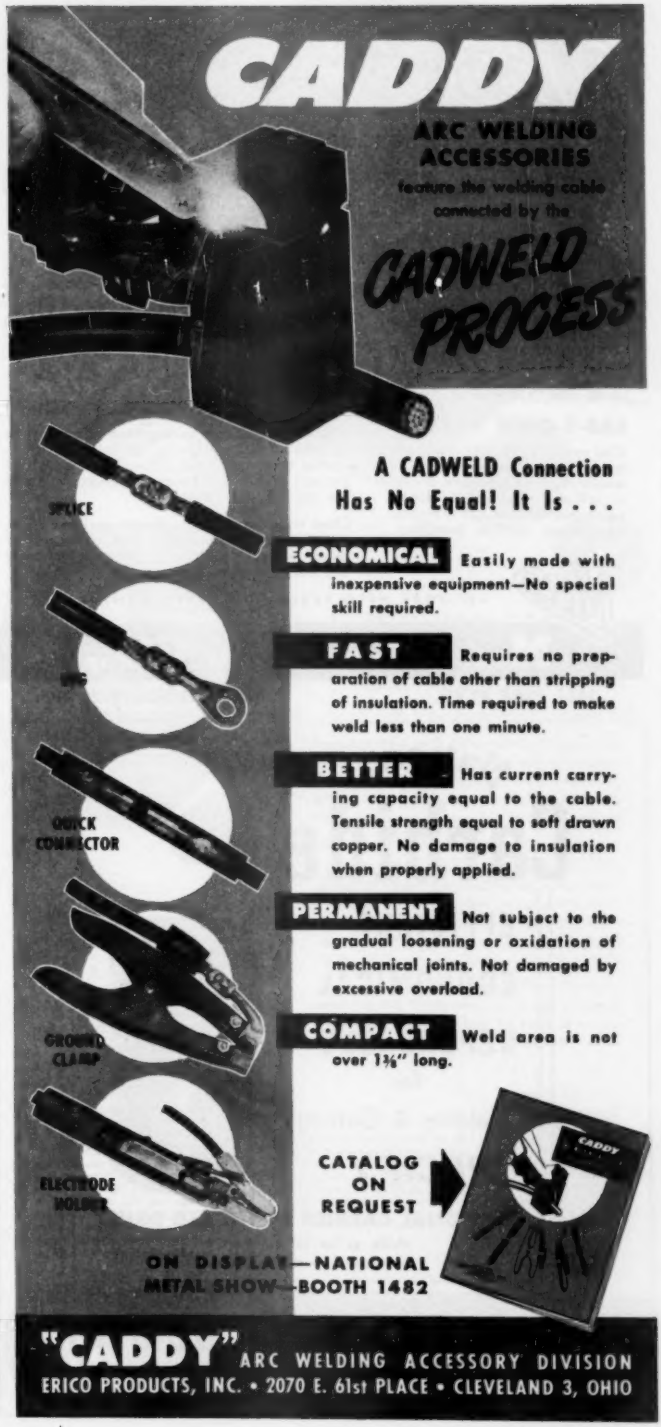
C. T. Posey, 38, passed away Aug. 25 after an eight months' illness with leukemia. At the time of his illness he held the post of research engineer for Arcos Corp., Philadelphia. Well-known over the nation for his welding knowledge, he worked 8½ years at Crane Co. before going to Arcos. He spent 4½ years at the Philadelphia office of Arcos and 2 years in Chicago as resident field engineer. He was regarded as an expert on armor welding and ferritic electrodes. He returned to the home office for the post held at his death. His widow and two little girls survive him.

* * *

Hugh J. Fraser, vice-president in charge of plant operations for The International Nickel Co., Inc., died August 22 in New York after a brief illness. Born and educated in Ontario, Canada, Mr. Fraser was also an assistant vice-president of The International Nickel Co. of Canada, Ltd. He joined International Nickel at its Huntington, West Va., works in 1923. After serving in various technical and operating capacities, he was appointed to his present position in 1948.

* * *

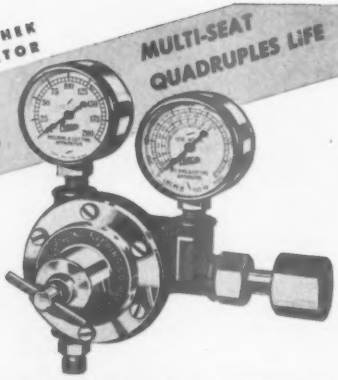
R. H. Sturgeon, western district manager for the Harnischfeger Corp., died August 8 after a four-story plunge down a hotel elevator shaft in Seattle, Wash. Death appeared to be accidental, according to the county coroner. He is survived by his wife, Mrs. Florence Sturgeon.


CADDY
ARC WELDING ACCESSORIES
feature the welding cable connected by the
CADWELD PROCESS
A CADWELD Connection Has No Equal! It Is . . .
ECONOMICAL Easily made with inexpensive equipment—No special skill required.
FAST Requires no preparation of cable other than stripping of insulation. Time required to make weld less than one minute.
BETTER Has current carrying capacity equal to the cable. Tensile strength equal to soft drawn copper. No damage to insulation when properly applied.
PERMANENT Not subject to the gradual loosening or oxidation of mechanical joints. Not damaged by excessive overload.
COMPACT Weld area is not over 1⅜" long.
SPLICE
GROUND CLAMP
CATALOG ON REQUEST
ON DISPLAY—NATIONAL METAL SHOW—BOOTH 1482
"CADDY" ARC WELDING ACCESSORY DIVISION
ERICO PRODUCTS, INC. • 2070 E. 61st PLACE • CLEVELAND 3, OHIO

Meco SAF-T-CHEK REGULATOR

LASTS . . . 4 Times longer

MULTI-SEAT QUADRUPLES LIFE



Four times the life of ordinary regulators is guaranteed by exclusive four-seat construction. Each seat may be used successively – adjusted simply. No special tools or mechanical skill is required to maintain *any* part of the MECO regulator.

SAF-T-CHEK VALVES

This exclusive MECO construction provides insurance against seat or diaphragm failure. Built-in, self-actuating SAF-T-CHEK valves prevent damage to equipment from careless handling.

BOLTED DIAPHRAGM NEVER PUCKERS

Absolutely uniform pressure and flexibility is secured by *bolting* special alloy diaphragm – instead of conventional screw fastening which puckers diaphragm fibres. Diaphragm should last the life of the regulator.

Close yoke between diaphragm and multi-seat block insures transmission and correction of tiniest pressure variations providing constant and uniform pressure.

Meco ASK YOUR MECO DEALER FOR FURTHER INFORMATION

Modern Engineering CO., Inc.

3411 PINE BLVD. ST. LOUIS 3, MO.

National Carbide

EFFICIENT

ECONOMICAL

DEPENDABLE

for

Welding & Cutting

SPECIFY

NATIONAL CARBIDE IN THE RED DRUM

Write us for information as to nearest available stock.

NATIONAL CARBIDE COMPANY

A Division of Air Reduction Company, Inc.

60 E. 42nd St., New York 17, N. Y.

NEW PRODUCTS

(Continued from page 88)

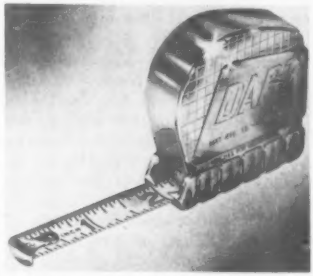
Universal Welding Jig

261 Up to four pieces or components can be held in any three-dimensional relationship for welding, brazing or soldering in the "Twinner Vise." The top plate assembly rotates in both directions through 360 deg. It also tilts to left and right through 180 deg. Angle plates with vises may be rotated to any position.

The Model 7 "Twinner" is mounted on a tripod base and can be profitably used for all light assemblies. A massive welded steel base on the Model 37 makes it suitable for much heavier work. Manufacturer states that several thousand of these positioners are in daily use in England and on the continent.

THE EDMANDS CO., Providence, R. I.

* * *



Steel Rule

262 THE NEW Dart steel rule gives more viewing area when inside measurements are taken. Readings are clearly seen at the indicator points. "Anti-popout" design keeps blade in case when not in use. Rule is offered in 6 ft, 8 ft and 10 ft lengths.

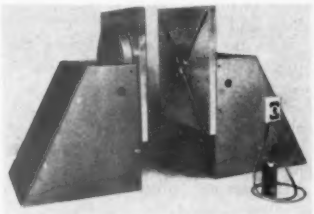
DART MFG. CO., Mason, Mich.

Crimping Tool

263 NEW mechanical-type hand crimping tool makes a full circumferential crimp and will crimp a range of wire and cable sizes from No. 4 up through 500 mcm without any changing of dies or application of heat. Yet the tool is light in weight (2¾ lb) and simple to operate. It works on a ratchet principle and rolls a crimp into the connectors and lugs. This portable tool can be operated in tight places.

F. M. ANTHONY CO., Piedmont 11, Calif.

* * *



Head and Tail Stocks

264 LARGE weldments can be positioned between the Model HTS5 head and tail stock positioner. The tables are the face plates the workpiece is attached to them. Rotation is in one plane only, the horizontal rotational axis. Speed is 1.13 rpm constant rate, a speed designed for either manual or automatic welding. Capacities of the three models of this type are 5,000, 12,000 and 32,000 lb.

Other features are magnetic brake motor, 110-volt control circuit on remote push-button station, anti-friction bearings, mercury grounding on both head and tail stocks, cam yoke roller on table for back-up to prevent table deflection under load.

ARONSON MACHINE CO., Arcade, N. Y.

To obtain additional information on listed new products, use the cards on pages 17-18.

NO MATTER WHAT METALS...

there's a GB silver brazing alloy and flux combination that will *Speed Your Production!*

SILVER
COPPER
BRASS
STAINLESS STEEL
BRONZE
STEEL
NICKEL
CHROME ALLOYS
GOLD
TOOL STEEL
CARBIDE
INCONEL
ETC.

Every day more and more fabricators are learning that GB Silver Solder with GB Flux makes an unbeatable production team for low temperature brazing.

From the GB line of six standard silver solders you can select the one which will fully meet your production specifications. Yes, with GB Silver Solders you get sound, low-cost joints on virtually any ferrous or non-ferrous metal.

GB Standard Silver Solders:

GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F

For special jobs where special silver solders are required, GB offers you competent technical assistance, backed by over 80 years of experience in alloying and refining precious metals.

GB FLUXES

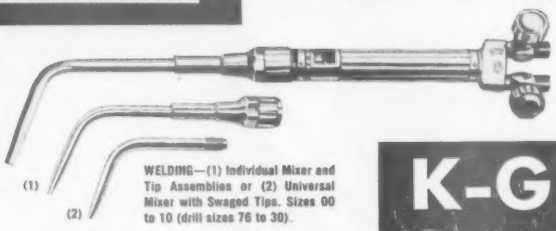
The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low-temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

GOLDSMITH BROS. SMELTING AND REFINING CO.
1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867

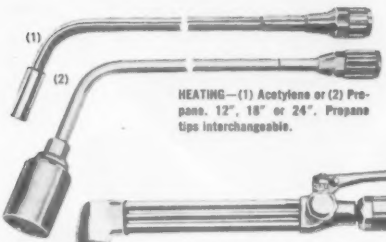
Versatility **Cuts Costs!**



(1) (2)

WELDING—(1) Individual Mixer and Tip Assemblies or (2) Universal Mixer with Swaged Tips. Sizes 00 to 10 (drill sizes 76 to 30).

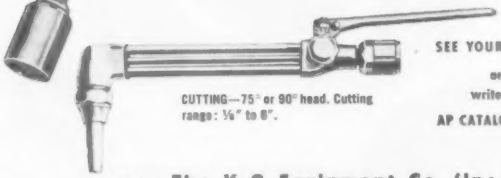
K-G's AP Welding & Cutting COMBINATION



(1) (2)

HEATING—(1) Acetylene or (2) Propane. 12", 18" or 24". Propane tips interchangeable.

ALL PURPOSE. Takes a wide variety of tips. Excellent for brazing, welding, heating, cutting. Rugged, efficient, dependable.



CUTTING—75° or 90° head. Cutting range: ⅛" to 8".

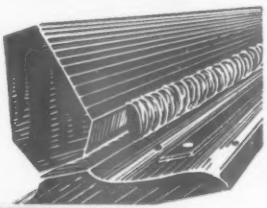
SEE YOUR K-G DISTRIBUTOR or write for AP CATALOG SHEET

The K-G Equipment Co. (Inc.)
Unit of Air Products, Inc.
Dept. A, 1744 Lehigh Street, Allentown, Pa.

Booth #1662 at the Metal Show!

TRACTOR SHOES LAST LONGER . . . COST LESS

When You . . . **Repair Worn TRACTOR GROUSERS** with . . . **MANGANAL**



U.S. Patents 1,876,738—1,947,167—2,021,945

11%-13½% Manganese-Nickel Steel

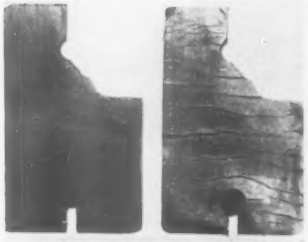
SPECIAL SHAPE APPLICATOR BARS

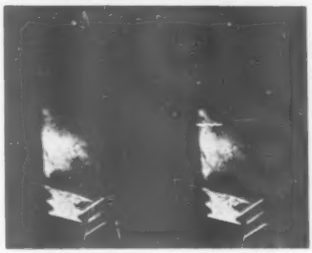
- Workharden to 550 Brinell. Tensile strength to 150,000 p.s.i.
- Provide stronger, longer-lasting replacements —cost less than new parts.
- Practically eliminates build-up welding.
- Easily fabricated hot or cold without injury to metal.
- Outlast other steels due to its extreme toughness and high resistance to impact and abrasive wear.

FREE booklet on the newest methods of economical repairs to TRACTOR SPROCKETS, ROLLERS, IDLERS, BLADES, CORNER BITS.

NEAREST DISTRIBUTOR UPON REQUEST

STULZ-SICKLES CO.
SOLE PRODUCERS 92 N. J. RAILROAD AVE. NEWARK, N. J.





Metal Inspection Inks

265 Two new non-destructive methods of locating cracks and flaws in weldments and castings utilize special inks. One is called "Supramor" electro-magnetic flaw detection ink and is designed for ferrous metals. "Glo-Mor" fluorescent crack detection ink gives clear indication of surface cracks in non-ferrous alloys and plastics.

With the "Supramor" method, the object to be inspected is magnetized and the ink is poured over its surface. Magnetic particles in the ink collect at cracks and other flaws to clearly outline them (at right, top photo).

The second process, "Glo-Mor," involves dipping the non-ferrous or plastic object into a fluorescent ink solution and allowing it to dry for about a minute. The impregnated test piece is inspected under an ultraviolet light source after drying. Surface cracks reveal themselves by their brilliant green fluorescence (bottom photo, right). This ink is said to be non-toxic.

MANCHESTER OIL REFINERY LTD., Manchester, England.

* * *

Anti-Corrosion Liquid

266 THE protection of mild steel from corrosion after it's been cleaned is provided by a coating of "Kelite M-2." It is said to be superior to petroleum oil in corrosion inhibition, elimination of need for drying and resistance to finger printing.

To obtain additional information on listed new products, use the cards on pages 17-18.

"Kelite M-2" may be applied by immersion, spray or brush. It is not readily flammable (flash point 140 F), non-phenolic and non-toxic. In addition, it is said to be harmless to skin or nostrils. It will displace and absorb up to 11% of its own volume in water without impairment of efficiency.

KELITE PRODUCTS INC., Los Angles 12.

* * *

New A-C Welders

267 REDESIGNED industrial models of a-c welders in 300, 400 and 500 amp capacity have been brought out by Lincoln. The more compact design has the same output and overload capacity as previous models and incorporates the patented "arc booster" circuit brought out several years ago. The easy-to-read front-mounted-amperage dial is illuminated by an accessible 6-volt lamp.

All electrical and mechanical control parts required for connecting or that need maintenance are readily accessible without removing the case. Reconnection of the input circuit for 220 or 440 volts can be done without replacing any coils. An improved downdraft ventilation system brings air in from the top of the case.

To be exhibited at the Metal Show in Philadelphia this month are several other Lincoln welding developments. They include a new hard-facing flux for use with automatic submerged-arc welding. With this flux a standard mild steel electrode is used, the hard-facing elements being contained in the flux and alloyed in the arc. Semi-automatic submerged-arc welding adapted to a gas-engine-driven welder will be shown. A "twin-arc" process of submerged-arc welding in which two electrodes will be fed in tandem to deposit metal in a single crater will also be demonstrated.

THE LINCOLN ELECTRIC CO., Cleveland 17.

SPEED PRODUCTION

...by putting your clamping burden on

KNU-VISE AIR CLAMPS

MODELS AVAILABLE TO GIVE YOU PRESSURES RANGING FROM 80 LBS. UP TO 2875 LBS.

Can bring you efficiency in several ways:

1 — in single installations where operator's fatigue is a factor or where the location of hand-operated clamps would be impractical.

2 — in multiple installation controlled by a single valve.

3 — in multiple installations with sequence valves operating certain clamps at predetermined intervals.

Sales offices in principal cities. Teletype DE 49

Send for new folder giving further information.

KNU-VISE PRODUCTS — LAPEER MANUFACTURING CO.
3042 DAVISON ROAD • LAPEER, MICHIGAN

Western Division, 422 Magnolia St., Glendale, Calif.

BECKER HAS IT OR CAN MAKE IT!

IF IT'S CARBON

KEEN-ARC CARBONS

Cored and heavily copper coated for twin arc torches

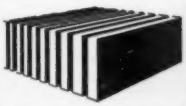
WELDER BRUSHES

The "right" brush for every type and make of welding equipment.

ELECTRODES and RODS

All standard types and sizes

PLATES



1/4" thickness and up.

PASTE

Heat resistant, easily molded

PLATES and PASTE ASSORTMENT

$24.50

A handy assortment, developed especially for welding departments or small welding shops.

COMPLETE BECKER ENGINEERING SERVICE is always available and entails no obligation whatever.

BECKER BROTHERS CARBON CO. 3450 SOUTH 52nd AVENUE CICERO 50, ILLINOIS, U.S.A.

HOBART
12 electrode
(E-6012)

...for use in any position with *AC* or *DC* current

What ONE electrode can handle 80% of all your production work? What ONE electrode is today's best buy for all-purpose welding? The answer to both questions is the same — the Hobart "12". It's truly a premium electrode in both quality and performance — yet actually costs you less than any other E-6012 electrode because it gives you more actual weld deposit, increased production, less clean-up time.

YOU CAN STANDARDIZE on Hobart "12"—many of the country's largest fabricators of tanks, automobile frames, agricultural implements, etc., already have. They tell us that the Hobart "12" is the most versatile electrode they have ever used. They tell us, too, that the Hobart "12" goes further—leaves more actual weld deposit per electrode because there's less spatter and less stub loss, even when higher than normal welding currents are used.

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Simplify all your welding by using HOBART ELECTRODES

Fluxless Aluminum Rod

268 "CHEMALLOY" is an alloy of metals and chemicals that is said to permit either welding without fusion (soldering or brazing) or welding with fusion (true welding). The difference between welding and soldering with "Chemalloy" is merely that of degree of temperature. Soldering, naturally, requires less heating. This product is used to join any aluminum alloy or any zinc-base metal, including materials with aluminum or galvanized coatings.

"Chemalloy" simplifies the technique to merely heating of the aluminum joint to 600 F or over. At the 600 F temperature, the "Chemalloy" is melted directly on the aluminum without the use of any flux or special preparations. Tensile strength of the weld is said to be greater than that of the parent metal. Results from salt spray and acid tests have also been good.

"Chemalloy" is derived by the use of muriatic acid to mix with, cleanse and homogenize molten blends of zinc, aluminum, copper, lead, tin and certain additives. Normally, the muriatic acid would cause an explosion when introduced into molten metals; the explosive force, however, is controlled by conversion of the explosive force into thousands of miniature reactions.

CHEMALLOY ASSOCIATES, Santee, Calif.

* * *

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269 REBUILDING of manganese steel parts on construction machinery may now be done with moly-manganese electrodes for both hand welding and automatic operations. The electrodes contain 14-15% manganese, with deposits showing full Hadfield properties, says the manufacturer.

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STOODY CO., Whittier, Calif.

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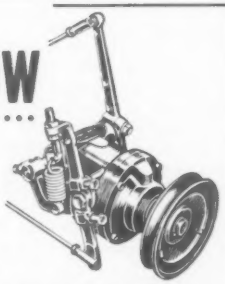

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MILLER ELECTRIC MFG. CO., Appleton, Wis.

* * *

New Product Briefs

271 Alcoa C57S will take an unusually brilliant "Alumilite" finish and is believed to hold great promise in the field of automobile trim. It could be used, states manufacturer, as an attractive and long-lasting replacement for chromium plating and stainless steel. Aluminum Co. of America, Pittsburgh 19.

* * *

272 Slide rule 9 in. long permits a comparison of welding electrodes in a matter of seconds. This handy device is available at General Electric Company's welding distributors.

* * *

new type paste flux

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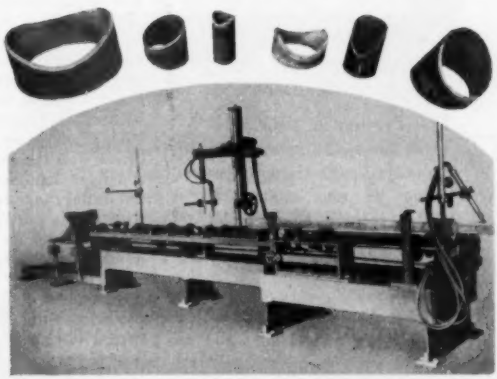
No layout or templates required . . . cuts are burned automatically to accurate shape and size by quick cam adjustment. Machine is also ideal for production runs if identical cuts are desired. Cuts alloy steel pipe by using powder type torches.



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The VERNON "Pipe-Cutting" PANTOGRAPH is extremely simple to operate. Requires no special skill . . . pipe is merely laid on top of rollers.

VERNON TOOL CO., LTD.

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VERNON "Pipe-Cutting" PANTOGRAPH

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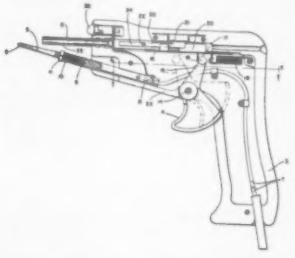
Arcair

2614 Burwell Street BREMERTON, WASH.

From the Patent Office

Soldering Gun

2,604,571. HOWARD W. NAULTY, East Aurora, and MALCOLM N. BROWN, Kenmore, N. Y. Assigned by mesne assignments to Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y. Filed Oct. 31, 1946. Granted July 22, 1952.



This recently patented soldering gun has a body adapted for holding in one hand and a pair of closely spaced electrodes carried by the body and insulated from each other. The electrodes are metallic and of sufficient cross-section to remain relatively cool as compared to the work. They are adapted to be placed in contact with the work to complete a heating circuit spot primarily within the work itself. A solder guide and solder wire are mounted on the body and directed between the electrodes but spaced from them so as to apply the solder directly on the heating spot of work. A trigger has two ranges of motion, the initial range to advance the solder wire and retract it for inspection of the result and the final range to only advance the solder. A movable grip engages the wire and is operated by the trigger to both advance and retract the wire with small strokes of the trigger during the initial part of the trigger travel. A supplementary grip is engaged during the final part of the trigger travel to hold the wire against retraction. The second-mentioned grip when so engaged predominates over the first grip so that the latter may then feed the wire only forward. This is so the operator can control soldering and inspect the result before definitely feeding more solder forward.

* * *

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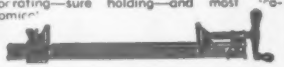
"PONY" Clamp Fixtures make ideal bar clamps on any length of black pipe. Fast operating—sure holding—and most economical.



"JORGENSEN" Steel Bar Clamps are designed for the severe requirements of welding service; exclusive "multiple disc clutch" makes for instant adjustment—economy. The trade-mark "JORGENSEN" or "PONY" on your clamps is assurance of utmost satisfaction in service—specify and insist upon them from your supplier. FREE CATALOG ON REQUEST.

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Brazing 718

Aluminum Solder

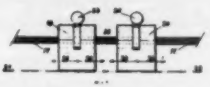
White Metal

Welding Alloys Manufacturing Co.

744 Broad St. Newark 2, N. J.

Method for Cutting Cables, Tubes, Etc.

2,606,266. GABRIEL V. A. DUCH and MARIE A. DUCH, Lyons, France. Filed March 24, 1950. Granted Aug. 5, 1952.



This patent refers to a method of electrically cutting off cables, tubes, bars, or similar elongated metal parts having metal and textile strands within the range of a set cutting zone. Encompassing jaws are tightly applied on the part to be cut on both sides of the cutting zone. These jaws have a sufficient contact surface to permit the flow therethrough of an electric current of adequate intensity for melting the zone where the part is to be cut. An intense current is made to flow through the jaws, which are then slightly brought together while the metal melts. This forces and bunches the molten metal so that when the jaws are moved apart the molten section is cut asunder.

* * *

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Why not find out?

Just phone your nearest *CHAMPION* sales agent or distributor . . . let him make a "house call." Perhaps he can diagnose the trouble you're having. There's no cost or obligation whatsoever.

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Rexarc is a Product of

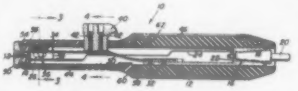
THE SIGHT FEED GENERATOR COMPANY

West Alexandria, Ohio, U.S.A.

Manufacturers of Welding Equipment For More Than 25 Years

Electrode Holder

2,604,568. HERBERT H. PEYREFERRY, Eddystone, Pa. Filed Jan. 26, 1950. Granted July 22, 1952.

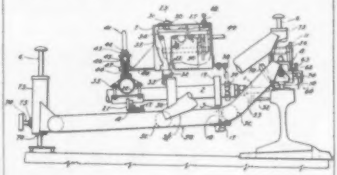


A new welding electrode holder comprises an elongated barrel of conductive material having a pair of diametrically opposed slots in one end. The barrel also includes an elongated, central, troughed part and a tongue integral with and extending from the end of the barrel remote from the slotted end and overlying a part of the troughed section. Parallel, inwardly directly flanges on the end of the tongue form an axially extending channel-shaped groove on the tongue. A resilient strap has one end received in the groove and has its other end terminating between the diametrically opposed slots to resiliently engage a welding rod extending through the slots. One end of the strap is secured in the groove and is maintained against lateral movement by the walls of the inwardly-directed flanges. The barrel has an opening in it intermediate its ends on the side wall opposite the trough. A strap release knob is slidably and guidably received in the opening and is secured to the strap intermediate its ends. An insulative sheath is disposed about the barrel and has an aperture therein conforming to and registering with the barrel opening. The knob is slidably and guidably extended through the sheath aperture to non-slidably and non-rotatably retain the sheath on the barrel. A conductor is secured to the remote end of the barrel. The remote end has an axial bore therein, the conductor being received in the bore.

* * *

Rail-Surfacing Machine

2,601,383. HARRY S. GEORGE, Massapequa, N. Y. Filed Aug. 16, 1948. Granted June 24, 1952.



This patent refers to a surfacing machine for use in repairing battered rail joints comprising, in combination, an oxygen-cutting torch and carriage and means for positioning it so that excess weld metal may be removed or shaped.

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1 One piece back.
2 One piece palm.
3 Thumb seam protected by wide leather strap.
4 All vulnerable seams welted.
5 Palm side of thumb is protected by extra leather overlay.

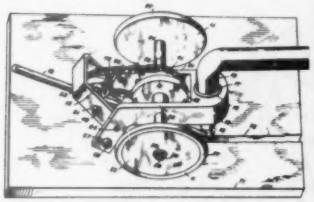
• Send for booklet on these and other GAUNTLETS Protective Equipment.

RACINE GLOVE COMPANY, INC.

RIO, WISCONSIN

Welding Rod Feeding Device

2,602,412. CARL H. GERLACH, Maple Heights, O. Filed May 3, 1948. Granted July 8, 1952.



A newly patented welding rod feed device attaches to a carriage having a welding torch tip mounted on it. The rod is automatically fed by movement of the carriage. An improvement comprises a first motion-transferring wheel fixedly and co-axially connected to the shaft of the rotatable carriage wheels and first and second contiguous, vertically-displaced rod guide wheels for guiding the rod there between including respective centrally-rotatable axles mounted on the carriage displaced from and parallel to the shaft of the carriage wheels. A third rod guide wheel is fixedly and centrally mounted on the carriage wheel shaft for guiding a welding rod in cooperation with the first and second guide wheels at an inclined angle into the welding torch tip. First and second belt engaging wheels are mounted on the respective axles for rotating them in response to an external force applied to them. A belt extends from the motion-transferring wheel to one of the belt-engaging wheels which will feed the rod into the working area as the carriage wheels are moved in a given predetermined direction.

A rod feeding machanism comprises a frame having a welding torch and a rod feeding attachment on it. Wheels including outer rims make contact with a working surface and a central shaft member. Special means couple the shaft to the rod feed mechanism. First means couple the rotary motion of the rims of the wheels to the rod feeding attachment through the shaft member for causing the latter to feed a rod toward a working surface when the carriage wheels are rotated. The first means includes a one-way drive mechanism for coupling motion to the shaft member in only one direction of rotation of the wheels. By this method the rod feed may be selectively controlled by a back-and-forth motion of the frame.

* * *

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for dependable
PERFORMANCE

"FLUXINE" Fluxes are the result of over fifty years of scientific research into the metal-joining field. There are 25 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes produce no injurious fumes to irritate eyes or nose of the operator.

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No. 4 FLUXINE, in powder form, for welding cast iron with bronze rods.

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When a touch on a button moves weldments like these into the correct, most convenient position for a downhand pass, you get more arc time, more welding at lower cost. C-F power operated Positioners rotate the work in a full circle at any point in a range of 135° from the horizontal—giving welders a choice of an infinite number of downhand welding positions instantly.

Every requirement for faster, better positioned welding—constant or variable speed table rotation, full 135° tilt, self-locking gearing which holds the table in any position, oversize built-in main tilt and rotating bearings, choice of two base styles, and many other features—are built into C-F Positioners.

C-F Positioners are available in Hand or Power operated models, and are made in capacities up to 30,000 lbs. and larger.

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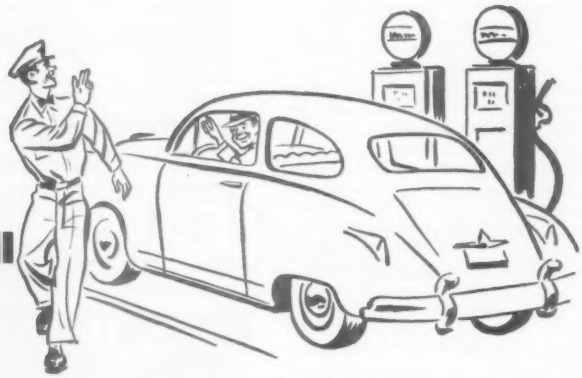
CULLEN-FRIESTEDT CO., CHICAGO 23, ILL. C-F positioned welds mean better, more economical welds

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"



Nobody knows for sure how it started—this line about "See you at the Polls!" we're hearing all over these days.

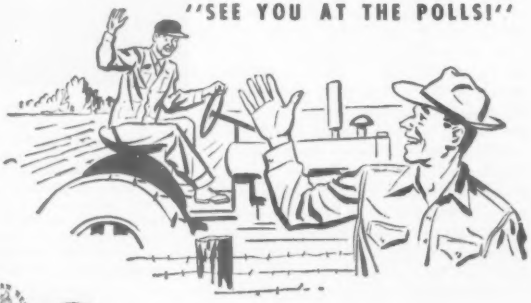
Best explanation seems to be that it came from that state candidate out west. . . . His opponent in a debate got all riled up and challenged him to fight it out in the alley.

But he said—"I'll settle this the AMERICAN way—I'll see you at the polls!" And the audience picked up the chant.

Now everybody's saying it—and on Nov. 4 everybody will be *doing* it!

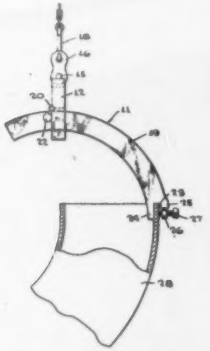
"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"



Supports Fittings While Welding

2,601,407. LEE W. MARSHALL, Terre Haute, Ind. Filed June 22, 1951. Granted June 24, 1952.



This patented device is a supporting member for pipe fittings while they're being welded. It comprises a link bar with a vertical slot, a curved bar that extends through the slot and a pipe-gripping means on the lower end of the curved bar. A depending anchoring element is fastened transversely on the link bar at the top end of the slot on the side of the link bar opposite the lower end of the curved bar. The anchoring element is arranged to grippingly engage the top edge of the curved bar responsive to the application of a load to the lower end of the curved bar. An element is carried by the link bar and is arranged to clampingly engage the curved bar.

* * *

Welding Metal and Metal-Ceramics

2,599,751. HERMANN FEDERSPIEL, Terlano, Italy. Filed May 19, 1949. Granted June 10, 1952.

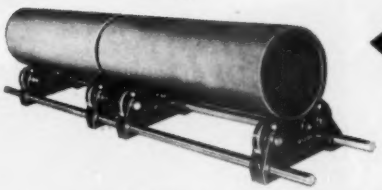
This patent covers a welding process for joining a metal body and a semi-conductive body. The latter body is comprised of a mixture of a small part of metal and large part of metal oxide and ceramic material. The welding process consists of placing the two bodies closely together and subjecting them to a welding temperature in the presence of a reducing atmosphere. This is continued until the metal oxide contained in the semi-conductive body is transformed into metal in its elemental form. This molten metal then forms a joint with the molten metal of the other workpiece.

* * *

Hain't we got all the fools in town on our side? And hain't that a big enough majority in any town?—Mark Twain

WORK ROTATOR

MANUFACTURERS
ASSEMBLERS
WELDERS



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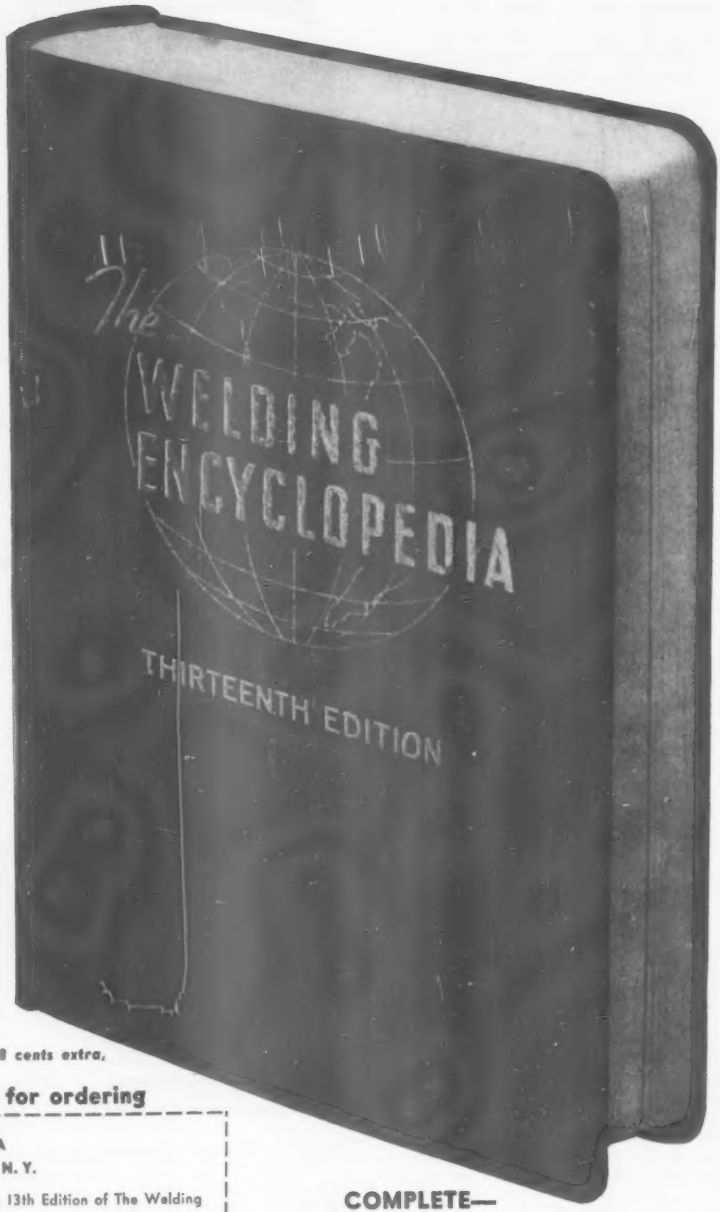

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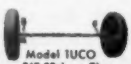

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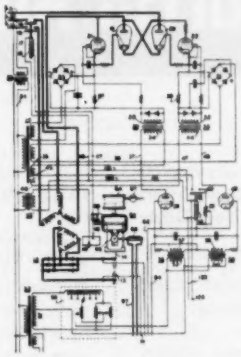
R-W Welding System

2,597,959. CLYDE E. SMITH, Warren, O. Assigned to The Taylor-Winfield Corp. This application filed July 18, 1949. Granted May 27, 1952.



Patent refers to an electric resistance welding system having a welding transformer and a rectifier connected to the secondary of the latter for supplying one-way welding current. There are a combination of means to effect welding pressure, the means comprising a solenoid and an energizing circuit for it to varying the welding pressure during the welding cyclex. The energizing circuit comprises a capacitor and a grid-controlled gaseous discharge device in series therewith. A source of grid-biasing potential for the said device comprises a timing capacitor, a relay operative when energized to initiate a change in the charge on the timing capacitor and means to energize the relay. The latter means comprise a controlled discharge device having its control circuit connected across the output of the rectifier.

* * *

Rail Signal Connection

2,604,570. KARL JOE AVERSTEN, Lidingo, Sweden. Filed Jan. 6, 1950. Granted July 22, 1952.

A newly patented method of electrically connecting or bonding a pair of rails utilizes a pair of contact shoes to be attached to the rails. They are mutually connected by a conductor. A contact shoe is inserted into a holder connected with a source of electrical energy. One end of the holder is pressed against one of the rails so as to make the end of the contact shoe abut against the rail while applying energy from the source through the contact shoe to the rail.

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Advertising men agree – to do a complete advertising job you need the double effect of both Display Advertising and Direct Mail.

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PUBLISHING COMPANY, INC.
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5 SECONDS or LESS To Notch Pipe and Tube Ends with ...

ARC-FIT

- Notches all sizes and shapes.
- Works in hand or power press.
- Does not deform tube or pipe.
- Cuts clean—no finishing needed.
- Reduces production time, costs.

Write for Bulletin

VOGEL TOOL & DIE CORP.
1817 N. 32nd Ave., Melrose Park, Ill.

Mr. Welding Manufacturer:

The Mid-June issue of THE WELDING ENGINEER features a review of the welding industry for 1951. It shows how big the industry is and how it is *growing*.

Indications point to an even bigger year in 1952 and a continuing growth beyond that.

Are you getting your share of this important market? Advertise your products in THE WELDING ENGINEER, America's pioneer welding publication for ready acceptance. Write today for rates, circulation information, etc.

THE WELDING ENGINEER

330 W. 42nd St. New York 36, N. Y.

30 YEARS AGO

C. A. McCUNE, president of the American Welding Society, addressed the first fall meeting of the Cleveland section on Oct. 12. The meeting was held in the Hotel Winton, in the rooms of the Cleveland Engineering Society.

—30 YEARS AGO—

ATTENTION is called to the fact that many weldors do not know that it's possible to buy welding lenses that not only protect the eyes against the glare of the welding flame or arc but also correct defects in vision. Possibly a considerable share of the blame laid to the welding process in some instances could be traced to faulty vision of the welding operator.

—30 YEARS AGO—

ADVICE from China on the welding of pipes and boilers has come from the China Oxy-Acetylene Welding Works, Shanghai. Over there, weldors have to prove three years' experience on pressure-welding jobs before they can work on pipes and boilers.

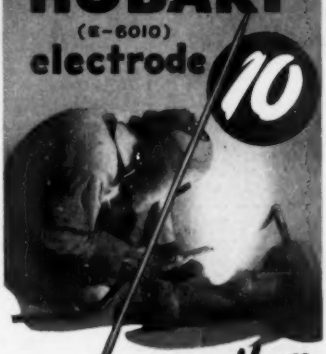
—30 YEARS AGO—

EMPLOYERS should realize that assigning their lead weldor to train the new men in the welding department isn't the end of their responsibility. Too often, this instruction is of high quality but lacks any system and is therefore quite wasteful. A written outline of the course will save time for the instructor. It will also tell the foreman how much instruction a new man has had, if the beginner refers to the outline.

—30 YEARS AGO—

"Where did you hire the guy on that overhead job?"

HOBART (E-6010) electrode 10



Faster, Smoother —non-porous welds in all positions

Maybe some E-6010 electrodes are hard to handle. But not the Hobart "10". You'll find that this new and versatile all-position electrode gives you real welding ease—PLUS—deep penetration, high tensile strength and ductility, quick and easy slag removal, a stable arc, and non-porous welds.

The Hobart "10" is widely used in structural work, ship building, pipe line construction, etc. Its penetrating arc makes it ideal for welding galvanized plates.

Yes, the Hobart "10" is years ahead of any electrode you may be using. But don't take our word for it. Instead, write us today for complete information and free samples to try on your next job. You'll be glad you did.

Overhead weld in 3/8-in. plate welded with Hobart No. 10 electrodes.

Vertical fillet weld in 3/8-in. plate welded upward with Hobart No. 10.

Whatever the position . . . the Hobart "10" gives you better, faster welds at lower cost.

HOBART BROTHERS COMPANY
Box U-1022, Troy, Ohio
"One of the world's largest builders of arc welders"

Simplify all your welding by using HOBART ELECTRODES

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(Classified Advertising)
H. E. Hilty, Mgr.

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90c a line, minimum 3 lines. To figure advance payment, count 5 average words as a line. INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rates, payable in advance.
PROPOSALS, 90c a line an insertion.

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DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
W.E.

NEW ADVERTISEMENTS: Address 330 W. 42nd St., N.Y. 36, N.Y. for November issue closing October 15th.

WANTED

Manufacturers Representatives for Transformer Type Arc Welding Equipment Line

Recently expanded production facilities enable us to accept applications for several choice territories. Exclusive assignment will be made to qualified representatives calling on and thoroughly acquainted in the Jobber & Dealer field and having good background in welding equipment.

We are a fast growing, well-established organization manufacturing a complete, competitively priced line of arc welders from 80 to 300 Amp Capacities. Prompt deliveries, lucrative commissions and full factory cooperation is assured. Inquiries invited from aggressive sales organizations handling related lines. Give full details in first letter. All replies confidential.

RW-5004, WELDING ENGINEER
520 N. Michigan Ave., Chicago 11, Ill.

STAINLESS STEEL ELECTRODES

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INDUSTRIAL AIR PRODUCTS CO.
3200 N. W. Yeon Ave.
Portland 10, Oregon

Size	Description		Type	Quantity
3/32"	Page	303	18-8	12,385
3/32"	Arcos Chromang	307	19-9	1,000
1/8"	Airco 2204	308	18-8	3,450
1/8"	Page	308	18-8	5,799
1/8"	Page	307	19-9	1,900
1/8"	Arcos Chromang	307	19-9	8,800
1/8"	McKay 5 AM	307	19-9	1,565
1/8"	Alloyrod Armorarc	307	19-9	32,245
1/8"	Sureweld Armo	307	19-9	2,700
5/32"	Page	308	18-8	3,005
5/32"	Arcos Chromang	307	19-9	9,750
5/32"	McKay 5 AM	307	19-9	11,620
5/32"	Alloyrod Armorarc	307	19-9	900
3/16"	P & H AW 3-C	307	19-9	3,850
3/16"	Sureweld Armo	307	19-9	635
3/16"	Racaloy	307	19-9	4,850
3/16"	Arcos		19-9 CB	100
5/16"	Page	307	19-9	2,050
1/4"	Lincoln Armorweld AR W-1			200

MANUFACTURERS REPRESENTATIVES

Excellent opportunity for high type manufacturers agents calling on welding supply distributors to handle our line of nationally advertised and accepted welding rods and fluxes. High income on new and repeat business.

RW5120 WELDING ENGINEER
330 W. 42nd St., New York 36, N. Y.

OXWELD CM-15s, Nat. 5s, Harris K's, Gaso S-24. AIRCO Oxy-graph, Camographs, Radiographs. SEAM WELDER, Progressive 150KVA, New. SPOT WELDER, National, 40 KVA for Brass and Stainless
BRONZE, STAINLESS, AMPCOTRODES
NO. 12 LENSES, ELECTRODE HOLDERS.

RALL SUPPLY CO. 6 E. 39th St., NYC 17

2—G.E. ATOMIC HYDROGEN ARC WELDING TRANSFORMERS

Model 6 WK 22A-1. Variable from 30 to 300 amps. Price $350 each.

3—TRANSFORMERS, ELECTRIC WELDING

Westinghouse, flex., ARC, AC, 1000 amps, Ser. No. 3139187, 440 volts, primary current, 193 amps, at rated load, single phase, style 125562, continuous one hour, 75° current rise, contains one Westinghouse transformer, type 3139188, 3213569. Price $650 each.

HERMAN MACHINERY & SUPPLY COMPANY
2110 St. Clair Ave., Cleveland 14, Ohio

METALLURGISTS

For control, process and welding. Also high temperature alloy—test and development.

THOMPSON PRODUCTS, INC.
Tapco Division
23555 Euclid Avenue, Cleveland 17, Ohio

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2 OXYGEN PLANTS, Independent 02-B, new, 600 cu. ft. per hour, 20-25 meters, complete less power unit.....$7,500 each
1 ACETYLENE PLANT, Linde, used, 500 cu. ft. per hour, complete, ready to run.....$6,500.00

DYE OXYGEN COMPANY, INC., MFGRS.
3332 W. McDowell Road, Phoenix, Arizona

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

OXWELD #1 HIGH TEST 3/16" DIAMETER
PERFECT CONDITION
500 lbs. minimum orders
Price varying with quantity and destination

CORP BROTHERS
1 Brook Street Providence 3, R. I.

CLOSE OUT—Greatly reduced prices.
Entire stock of new hose.

1150 ft. 1/4" Quaker Single Line Oxygen Hose
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150 ft. 1/4" Gates Twin Oxy-Acet. Hose
425 ft. 1/4" Quaker Twin Oxy-Acet. Hose (New Type)
3350 ft. 3/16" Quaker Twin Oxy-Acet. Hose
800 ft. 1/4" Quaker Twin Oxy-Acet. Hose
2400 ft. 5/16" Quaker Twin Oxy-Acet. Hose
36,000 ft. 1/4" & 5/16" Single Oxygen and Acetylene Hose

INDUSTRIAL AIR PRODUCTS CO.
3300 N. W. Yeon Avenue, Portland 10, Oregon

POSITION VACANT

DEPARTMENTAL HEAD—Store & Shipping. This position requires complete knowledge of all phases of welding; energy—ambition—and ability to handle personnel. This position will appeal especially to a young man meeting these qualifications, but not able to realize fully his ambitions. This is a fast growing progressive firm offering unusual opportunities for advancement and future economic security. Location—North Carolina. P-5446, Welding Engineer.

WELDING AND SETUP PLATENS
Shipyard Bending Block Type

5 ft. x 5 ft. x 6 in. thick—cast iron—wt. 2500± —planed top and 4 sides—152 sq. holes. Surplus stock.

STAHL EQUIPMENT CO.
94 Washington St. Brookline 46, Mass.

WANTED
WELDING RODS
ALL TYPES AND SIZES
AND STAINLESS STEEL WIRE
COILS OR STRAIGHT LENGTHS
STANLEY KESSLER
7304 Woodbine Ave., Phila. 31, Pa.

FOR SALE—(1) BRAND NEW MULTIPURPOSE FLAME CUTTING MACHINE

Complete with standard equipment including (2) 8' long sections of straight track. Built by Higgins Industries, recently acquired by Livsay Industries. Present List $550—will accept $225 F.O.B. St. Louis.

Hill Equipment Engineering Co.
St. Louis 10, Mo.

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WANTED TO BUY
Hydrogen Producing
ELECTROLYTIC CELLS
DIAMONDS AND TOOLS INC.
19345 John R St. Detroit 3, Mich.

IN 100-LB. LOTS, F.O.B. SCRANTON
SALE OF SURPLUS ELECTRODES

AMPCO-TRODE, 3/16" x 14" No. 10 Aluminum Bronze Coated D.C. Electrodes in Good Condition—70c lb.

SCRANTON WELDING SUPPLY COMPANY
1301 Wyoming Ave. Scranton, Penna.

6714 Bryn Mawr Ave.

The Reader AUDITED PAID CIRCULATION ABC *His Mark*

THE ABC SYMBOL which is printed at the head of this page is, in a very real sense, *your* brand on this magazine. Those letters stand for Audit Bureau of Circulations. The symbol indicates that the magazine is a member and supporter of that Bureau.

To the advertiser who contemplates using the magazine as an advertising medium, this symbol has a well-recognized significance. It tells him that the circulation records and practices of the magazine are wide open to the auditors of the Bureau, who check the publisher's claims and make public the precise terms and conditions under which subscriptions are obtained. And it assures him that the magazine stays in business by virtue of a demonstrated demand from its readers as shown by their paid subscriptions or newsstand purchases.

BUT HERE we are concerned only with the significance of ABC to you as a reader. For when the advertisers, the advertising agencies, and the publishers founded the Bureau nearly forty years ago to help establish honest circulation figures, they unwittingly set up a cooperative institution that has become a major safeguard for the interests of the reading public.

That is because membership in ABC constitutes one of the strongest guarantees that any publication can offer of its primary devotion to the interests of its readers. And by making that guarantee possible, ABC becomes a major safeguard of the freedom of the press, an objective of exceptional importance in these days when the public is flooded with propaganda from so many sources.

THE SUREST MEANS by which to preserve a free press is to keep it directly answerable to the reading public it would serve. It follows, then, that the survival of a truly free press must depend on its acceptance by that public; and that means in turn that the people must have in their hands some adequate means for holding the publishers responsible to them.

No one has yet devised any means to that end more simple, more direct or more practical than the paid subscription or newsstand purchase price. The right to purchase or refrain from purchasing a publication gives to the readers and to no one else the power to pass judgment on whether that publication should continue to serve the reading public.

TO SUPERVISE this vital process, to check and certify the integrity of the publication's circulation methods and claims, requires a strict and continuing audit of each publication's success in meeting this test of its public acceptance. To that essential function the ABC has contributed mightily by the conscientious performance of its mission. And that is why we are able to have a press supported, for the most part, by advertising revenues, but not controlled as to its circulation or content by any influence other than its readers.

When an advertiser consults the ABC statement of a publication to ascertain the amount, the quality and the trend of its circulation, he does so in the legitimate pursuit of his own interest. But at the same time, inevitably, he is helping the ABC to keep the press responsible and responsive to the reading public. For, in effect, he is asking the publication to demonstrate through its circulation figures that it owes its standing to a voluntary demand by its readers.

SO THE Audit Bureau of Circulations, by auditing and certifying paid circulations, has come to perform a vital service to the readers of this magazine and of every other member publication. And in performing that service, it helps to maintain in our country a press that is answerable to the reading public and to it alone. So long as the practices and principles for which ABC stands continue to prevail in American publishing, we shall find in it a sure support for a truly free press, responsible only to the public it serves.

McGraw-Hill Publishing Company

RJ-38 TWECOTONG

"HOT-ROD" HOLDER

A BRUTE for BIG ROD and HIGH-AMPERAGE

ILLUSTRATION ACTUAL SIZE

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